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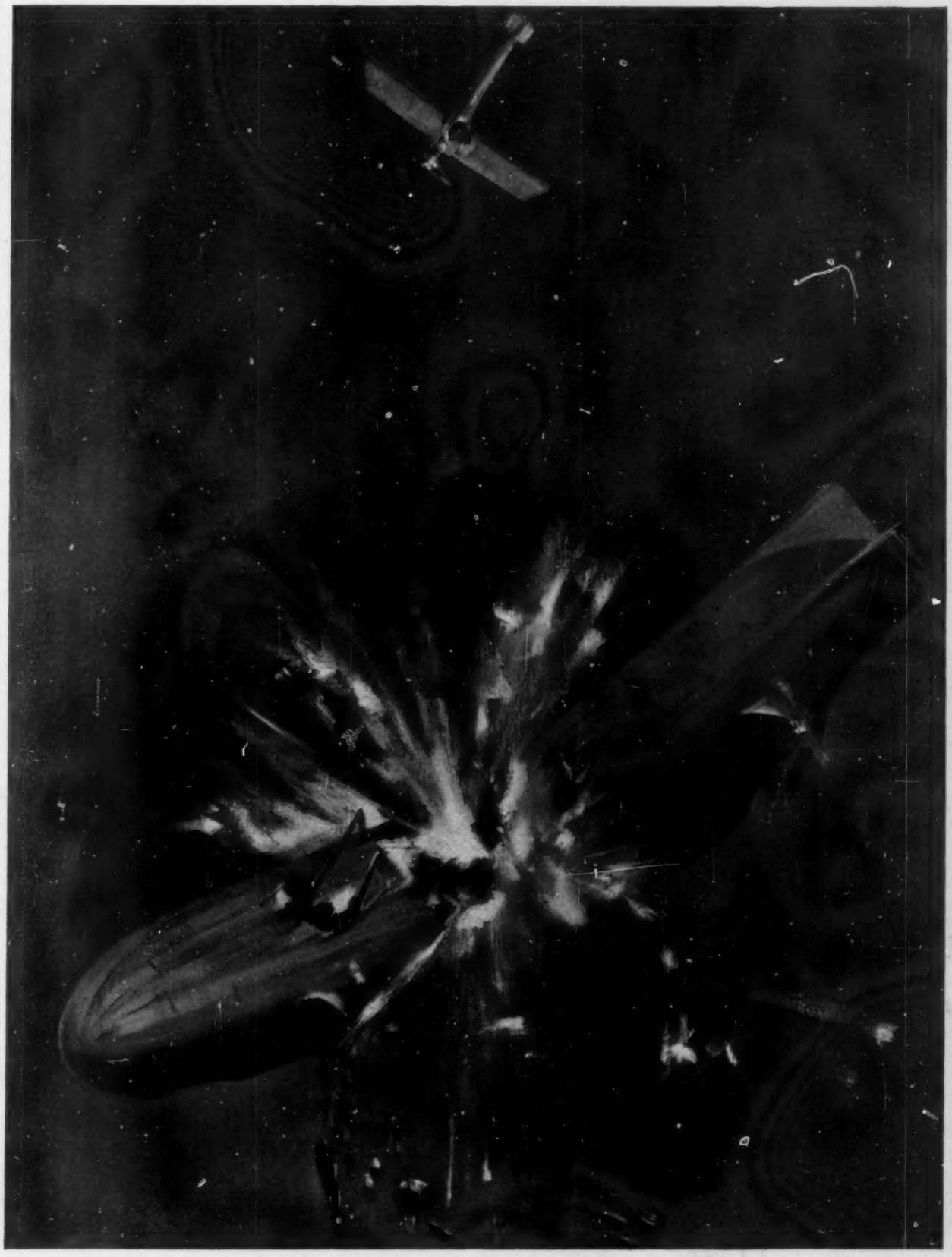

DESTRUCTION OF A ZEPPELIN BY A BRITISH MONOPLANE—[See page 627]

Vol. CXII. No. 26
June 26, 1915

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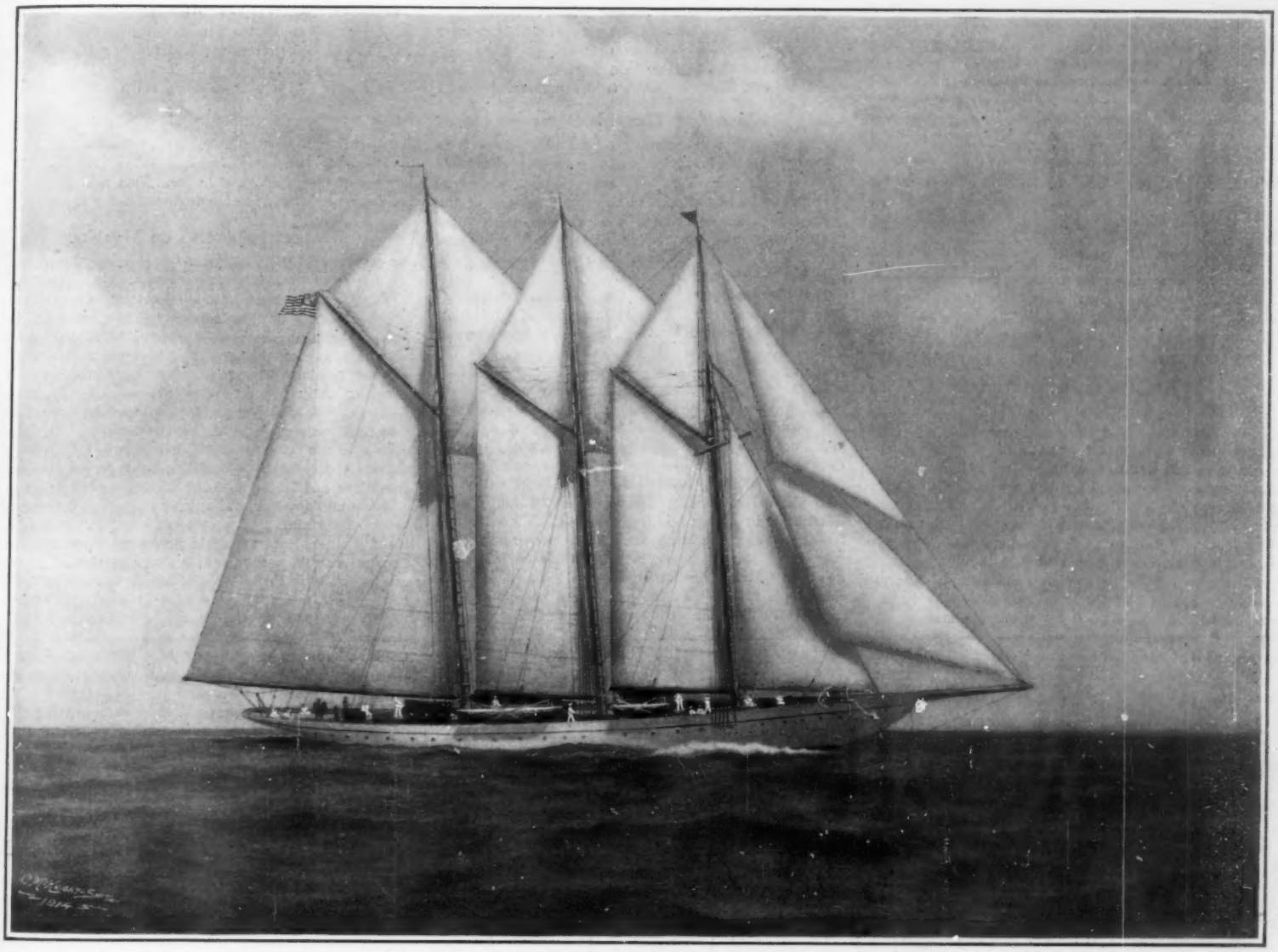
SEVENTY-FIRST YEAR

# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXII. NUMBER 26. ] NEW YORK, JUNE 26, 1915 [ 10 CENTS A COPY $3.00 A YEAR



**Length on deck,** 214 feet. **Length on water-line,** 150 feet. **Beam,** 33 feet 6 inches. **Draught,** 18 feet. **Height water to truck of mizzen mast,** 167 feet. **Auxiliary motor,** 400 horse-power kerosene.

**The "Sea Call"—largest fore-and-aft schooner yacht afloat.**

## The Three-masted Auxiliary Schooner Yacht "Sea Call"

THE auxiliary three-masted schooner yacht "Sea Call," recently launched at Lawley's yard, and now being completed for deep-sea cruising, is the latest and largest of the three-masted fore-and-aft schooner yachts of which several have been built in this country.

She has been built for Alexander S. Cochran, who is also the owner of "Vanitie," built last year for the defense of the America's Cup. Although she has been constructed primarily as a deep-sea cruiser, the size of the yacht, her refined model and her powerful sail plan, will probably render her the fastest sailing yacht afloat. If she should engage in racing during the present season, her ablest competitor, provided her owner places the boat in commission, would be the "Atlantic," the famous winner of the transatlantic race for the cup offered by the German Emperor. "Atlantic," also a three-masted auxiliary, was designed by William Gardner of this city, from whose draughting board also has come the "Sea Call."

The principal dimensions of the "Sea Call" are: Length over all, 214 feet; length on load waterline, 150 feet; beam, 33 feet 6 inches; and draft, 18 feet. Built for ocean cruising she is equipped with a complete seagoing rig, including square sail on foremast, three head sails forward, a short mizzen boom and gaff for offshore work.

The bottom of the hull is built of Monel metal which will be polished and not painted; the topsides and the framing are of a special steel made for this yacht. The frames are bulb angles, and the yacht has five steel bulkheads and seven deep web frames, which together will give great transverse strength to the hull. The deck beams are of channel steel and the yacht has been built under special survey by Lloyd and is classed 100-A.

On deck are two large Monel metal deckhouses for the use of the owner and guests, one between the main mast and the mizzen and the other just aft of the mizzen mast. The owner's accommodations consist of a large salon, 16 feet long by 31 feet wide, four large guest rooms, with two baths, and the owner's room with bath and also a large owner's storeroom. The owner's room is aft of the accommodations, and aft of this is a large chart room with lockers for stowing sails.

Below decks the finish of the yacht is simple, being entirely in white. The steering gear consists of a diamond screw gear placed below the deck. This is operated by a shaft from a stand on deck, which is equipped with two wheels, one on the fore and one on the after side of the stand. All the bearings of the steering gear consist of balls or rollers.

The three masts are of nickel steel and the rest of the spars are of hollow wood. Some idea of the enormous rig will be gathered from the fact that the distance from the water-line to the top of the mizzen truck is 167 feet. Because of the long overhang forward, the jib stay will set up on the stemhead. Since the boom extends but little over the taffrail, the sail, despite its great area, will be practically inboard in bad weather.

The motive power consists of an eight-cylinder gasoline or kerosene engine, developing 400 horse-power, at 250 revolutions per minute. The cylinders are 12½ inches in diameter by 20 inches stroke, and they drive a two-bladed feathering propeller of the Bevis type, seven feet six inches in diameter. There will be one 20-kilowatt General Electric dynamo set, one combination dynamo air and bilge pump, and one electrically driven ice machine. The hoisting of the anchor and the sails will be done by a bronze, electrically driven windlass, and there will be another electrically driven windlass on the afterdeck. As will be seen from our engraving, the "Sea Call" possesses the characteristic beauty of line which marks the Gardner yachts.

## New Uses for Infusorial Earth

OUR 6,500 tons of infusorial earth mined in Nevada and California is finding a ready market at $10.50 a ton. It has long been used in polishing powders and soaps and to absorb nitroglycerine forming dynamite and as a heat-insulating material in packing safes, steam pipes, etc., but now talking machine records are to be made from a boiled mixture of the earth and shellac. In Europe it is used to absorb liquid bromine, which they then put on the market as "so" lified bromine," and especially to absorb liquid manures for more convenient handling.

# SCIENTIFIC AMERICAN

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*The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.*

## A Great National Movement

IF the present Administration at Washington is desirous of keeping in close touch with the trend of public opinion on matters of national importance, it will do well to take note of the full significance of the remarkable series of public meetings which were held in New York during the past week under the auspices of the National Security League. No thoughtful observer could fail to have been impressed with the serious purpose, the earnest zeal, and the unanimity of opinion both of the distinguished speakers at the various meetings and of the large audiences which gathered to hear them. Also it takes but a glance at the list of officers and speakers and members of the League to realize that here we have represented all shades of political opinion—clear evidence of the fact that this movement is one of those whose springs lie deep in a consciousness of the fact that an issue of the gravest national importance is involved.

It is most unfortunate (and we speak here from direct personal knowledge and intercourse) that some of the leading members of the Government are making the same mistake of which they were guilty in regard to that other great non-political body, the Navy League. These officials have not hesitated to state in the most emphatic terms that the present movement for strengthening our national defenses is a purely political movement, aimed at weakening the influence of the present Administration.

Now, we have every reason to believe that nothing could be further from the truth. In the first place, it is only necessary to consider the list of the men who are prominent in this movement to see that it includes distinguished names from both the great political parties; and, furthermore, both in the literature put forth by these various movements for defense and in the public speeches of their accredited representatives, there is a remarkable absence of any evidence that the movement is political, and there is every evidence that its controlling motive is a patriotic desire to further the highest national interests of the country, irrespective of party or creed.

It may be laid down as a principle which cannot successfully be contradicted that there are some matters relating to the highest welfare of a nation, which are of such vital importance that they should be lifted far above the level of party strife and be safeguarded against the chances and accidents to which any mere party measure is inevitably exposed. Ranking high among these, surely, is the question of the security of a people and their country against invasion by a foreign power and the imposition upon them of the masterful will of a conqueror.

This, indeed, should form one of the very first, if not, indeed, the first object of government; and if the Administration fails to make every reasonable provision thus to safeguard the country against foreign attack, it is guilty of a very grave dereliction of its highest duty.

The existence and rapid development of the present popular movement to impress upon Congress the need for making considerable additions to our naval and military forces presents one of the most anomalous conditions that have ever occurred in the history of this Republic; for here we witness an attempt, on a very large and widespread scale, of the people to provide themselves with those defenses and to organize themselves for those military contingencies which should properly be the object of the earnest and active solicitude of their Government; but which, as matters now stand, the Government refuses to take any action upon or even earnestly to consider.

But the case is even more serious than that; for not only has the Administration refused to countenance this popular movement to find out the actual truth, but it has put itself in a position of active obstruction by placing a padlock upon the lips of every officer of the naval and military service. It has condemned them to silence, giving as a reason the desire of the Government to prevent these gentlemen from saying anything which might violate the absolute neutrality of the United States during the present war—as though, forsooth, the enlightenment of the people of this country as to the condition of their defenses could, by any stretch of the imagination, be construed as an act hostile to any of the belligerents in far-distant Europe.

## Learning Through Doing

WITH the beginning of the new school term in February, some of the public high schools in New York city entered upon a radical experiment in education. In the usual manner of the metropolis, this experiment was entered upon after having been tried out in other parts of the country. But it will also be tried on a more comprehensive scale than has ever been used before.

The plan in question is the so-called "Cincinnati Plan," first organized at the University of Cincinnati School of Engineering by Dean Herman Schneider; and it has several features that are of significance to the world of practical affairs.

In the first place it means that the educators have recognized certain limitations of the school room. From the assumption that "teaching" can impart all that youth needs to learn they have come to a lively realization of the fact that we can learn to do only through practice in doing. It is nearly three hundred years since Comenius laid down the maxim that children must learn to do by doing; and it is forty years since manual training was introduced into public schools in this country. But the schools, with all their devices, have not been training for the economic life of the day for the simple reason that the school can never duplicate industrial conditions. Once this fact is frankly accepted, the next step is plain.

The second point is that if young people are to learn to do things as they are being done in business, the shop and the office and the store are the right places for learning. This means that the students are to spend part of their time in industrial activities, and part of their time in school; for there is still much for the school to do. In the present plan, the high school pupils will spend alternate weeks in school and in the shops or offices.

Some inconvenience may be involved for the foreman or superintendent; but this is justified, for the plan makes the assumption that industry must share the responsibility for the training of its workers. With the decline of the apprenticeship system the training of artisans has become in many industries a haphazard drifting. In the course of time the managers of these industries have come to depend upon their competitors and the "public" to provide trained and experienced workers. The competitors shared in the waiting, and the public had not learned how to provide the workers, with the result that skill declined while the young people grew up without training.

A fourth point in the plan is the idea that certain large social problems—and education of the next generation is one of the largest—cannot be solved by any single agency, but must be attacked by two or more agencies co-operating to a common end. It is certainly significant that busy men of affairs, who have in the past asked only to be let alone, and the equally busy men of the schools, who have in the past asked only for a chance to mind their own business, can come together in the interests of the community's welfare and co-operate on a basis that is entirely strange to both of them.

It is interesting to note that this plan appeals at first only to those who have been accustomed to dealing with the larger problems of business policy and administration. The chief clerks and division managers who have reached the limits of their development are quick to reject the plan—because it is so different from what they are used to, because they have not the imagination to see its possibilities, because they are too much obsessed by their own routine. And the same thing may be said of the school men; the routineers are wedded to their routine.

The co-operative plan means getting away from routine in every way. The students will have work assigned to them according to carefully prepared syllabuses, with the purpose of allowing each one to learn the relation of the various processes to one another, and not merely to acquire skill at some specialized process. The work is to be progressive in the shop or office, just as it is planned to have the work progressive in school. On the other hand, the progress in the school is not to proceed along the insulated path of the old-style school: the school work is to be closely correlated to the practical work, through the activities of "co-ordinators"—specialists assigned to keep in constant touch with the students at their work and with their teachers at school. Moreover, the work is to be flexible enough to permit constant readjustment of the syllabus in the school as well as in the shop, as conditions may indicate new needs.

This plan has already demonstrated its workableness in several high schools throughout the country, and will undoubtedly lead to greater school efficiency as well as to greater economic efficiency. If it does no more than start the teachers and the employers along the path of experimentation and imbue them with the spirit of co-operation, it will justify itself in a very short time. But it will do much more both for education and for industry.

This is a radical departure from the methods of training used in the medical and legal professions, although it embodies the same fundamental principles. The success of the experiment in New York will accelerate the development of vocational education for the country.

## Weather Influences on Mankind

WEATHER influences on man may be roughly divided into two classes; viz., (1) those which are direct and obvious, and (2) those which are more or less indirect and obscure. The influences belonging to class (2) have been, during the past decade or so, the subject of immense research.

Some persons are pronounced "meteoropaths"—abnormally subject to "weather neuroses." Friedrich Nietzsche was one *par excellence*. Such persons as a rule are, more specifically, "cyclonopaths." The passage of cyclonic depressions, accompanied by certain characteristic types of weather, is reflected in their sensations and in the mode of operation of their bodily and mental functions. The gross change of barometric pressure pertaining to a cyclone, or "low," is not, in itself, an important factor in producing these manifestations, since it never exceeds that experienced in the ascent (without the effort of climbing) of a good-sized hill; indeed, many "lows" do not expose us to greater pressure changes in the course of twenty-four hours than we experience in a couple of minutes in riding to the top of an average office building. On the other hand, there are rapid, ripple-like fluctuations of pressure, revealed by the microbarograph and especially by the variograph, to which some people seem quite sensitive. The pathological effects of certain winds—e. g., the Swiss foehn—have been attributed to these minute fluctuations of pressure.

Again, the low pressure of a cyclone is said to favor the emission of radioactive emanations from the ground; atmospheric ionization is increased; the air becomes a better conductor of electricity; and the electrical charge of the human body is carried away at a more rapid rate than usual. This process, according to Escales and others, has a pathological effect in nervous subjects. We state the hypothesis for what it may be worth.

Solar radiation unquestionably affects mankind in ways other than those we recognize as ordinary light and heat effects. Such observations as those of Dorno, at Davos, show quite different annual curves for the different kinds of solar radiation contained in sunshine; and these observations suggest a reason for the very different effects upon human feelings and activities of spring and autumn, essentially the same temperature.

We have only grazed the vast subject of weather influences. We pause at this point to answer the question which many readers will be asking: Where have the students of these problems recorded the results of their investigations?

Certainly not to a great extent in Anglo-American medical and physiological literature. We have, indeed, many books and memoirs in English on the general subject of medical climatology, and on many topics of a kindred nature; but the information they contain is (speaking in general terms) about a generation behind that available to persons who read German.

There now lies before the writer a work published at Wiesbaden last year by Dr. B. Berliner, "Der Einfluss von Klima, Wetter und Jahreszeit auf das Nerven- und Seelenleben," which is representative of a very large recent German literature. To American students who do not read the *Zeitschrift für Balneologie, Klimatologie und Kurort-Hygiene;* who are not familiar with W. Schmidt's variograph studies nor with C. Dorno's remarkable investigations of mountain light and air; who know nothing of the work of such men as Hellpach, Frankenhäuser, Doye, Lehmann and Pedersen (the last two Danes who write in German), and the other leading recent Germanic exponents of climatophysiology and climatopsychology; to such persons the perusal of Berliner's work can be recommended for meditation.

## Notes on the War

**German High Fleet in the North Sea.**—The repeated rumors that the German battleships have been out in the North Sea, that a column of such ships has been sighted by trading vessels, and that the sound of the firing of heavy batteries has been heard, are possibly correct. Because of the submarine menace, the British blockade is not a close blockade off Wilhelmshaven and the mouth of the Elbe—it does not need to be. The German battleships at Wilhelmshaven require target practice, and it is possible for them to go out into the North Sea for this purpose. The German Zeppelins would be able to tell them when the coast was sufficiently clear for such exercises.

**"Goliath" Sunk by a Turkish Destroyer.**—Before the war the Turkish navy had come to be considered to be a practically negligible quantity, ill-manned, inefficient, and composed mainly of obsolete ships. Hence the recent torpedoing of the battleship "Goliath" by a Turkish destroyer has come with shock of surprise. It was believed that the rapid-fire guns of a battleship would pour such a hail of explosive projectiles against an onrushing destroyer, that it could never get within accurate shooting range. But the thing has been done and a battleship of the earliest pre-dreadnought type is on the bottom as the result. What with batteries with direct and indirect fire ashore, drifting mines, submarines and destroyers, the Allied ships in the Dardanelles are certainly having a lively time of it.

**No Tents in German Armies.**—It may or may not have been noticed by our readers that in the photographs of the theater of war, at least on the German side, no tents appear. That is one of the innovations which modern warfare has brought in the German army. Tentage used to form a not inconsiderable part of the impedimenta of armies, and this elimination lightens not a little the task of the quartermaster's department. The German plans contemplate always an offensive, presumably to be carried out in the enemy's country, and involve the billeting of the troops in the homes of the inhabitants of the conquered country.

**Building Destroyers and Submarines at Antwerp.**—Our contemporary, *The Navy and Army*, is inclined to believe that the two torpedo boats recently sunk off the Dutch coast by the British Navy, were built in Antwerp and came out from that port—this belief being based on the fact that it would be impossible for them to have come from Heligoland or Wilhelmshaven or even Emden, because the intervening waters are too well patrolled. Although Antwerp is in Belgium, warships constructed there would have to pass through Dutch territory by way of the Scheldt, to reach the North Sea. That would be a breach of neutrality; but the Germans evidently would not consider this an insuperable difficulty. The Belgian coast and the French coast up to Havre are greatly coveted by Germany, because of their nearness to the British south coast, and the control they would give of the English Channel.

**German Submarine Losses.**—Every naval officer who has had experience in submarine service is satisfied that the losses in the German submarine fleet during the war must have been very large, and this in spite of the fact that their submarine service is probably highly efficient. The British state that the Germans have lost from a dozen to eighteen submarines. The number lost by capture or foundering must by this time come pretty well up to the dozen mark. It is known, that the Admiralty has used every possible device to sink or catch these craft. Netting has played an important part and has scored, if we are to believe reports, some four or five successes. The practice is to stretch a great length of steel wire netting, suspended from floats on the surface, in other words, to spread a huge seine net, such as fishermen use for shoals of fish. When submerged, the submarine is absolutely blind, and if it runs into one of these extremely strong and tough nets, the propeller is likely to become entangled, while the disturbance of the surface floats reveals its presence and brings the dreaded destroyers to the spot.

**Italian Heavy Field Artillery.**—Evidently the Italian government has laid to heart the lessons of the German invasion of Belgium and France, at least so far as the question of heavy artillery is concerned. The present operations in the mountain passes leading into Italy from Austria are mainly artillery engagements for the destruction of carefully prepared permanent fortifications, and the capture of the passes by the Italian troops. Italy has prepared for this very kind of warfare, and she is undoubtedly well equipped with just the kind of howitzers needed for the reduction of the fortresses. Notable among these is a very effective 12-inch howitzer, a new piece which has given great satisfaction to the Italian government. That effective work is being done is shown by the remarkable ease with which the forts crowning the mountain tops and guarding the passes have been battered into helplessness and taken by the Italian troops. The Italians have ever been skilled engineers, and not for nothing have they learned the lesson of Liège, Namur, Maubeuge and other permanent fortifications reduced by the Germans early in the war.

## Science

**A Climatological Atlas of the British Isles** in two quarto volumes, is to be published by the Royal Meteorological Society in collaboration with the British Meteorological Office. Details as to its contents are given in the last number of the *Quarterly Journal* of the abovementioned society. The "normals" will be based mainly on the observations of the forty-year period 1871-1910, but monthly means will be given for each year from several stations having long unbroken records, such as London, 1774-1910. It is interesting to learn that the data of barometric pressure will be given in the new units, millibars, as well as inches. Heretofore only two countries have issued climatological atlases of so elaborate a character as the one proposed for the British Isles; viz, Russia and India. The forthcoming Agricultural Atlas of the United States will probably contain the largest collection of climatic charts ever issued for this country.

**The Rio Theodore.**—An accurate map of the famous river explored by the Roosevelt-Rondon expedition in Brazil, prepared from the compass traverse of Lieutenants J. S. Lyra and Pyrineos de Sousa, the two Brazilian army officers who had charge of the survey work of the expedition, has at last been published in the *Geographical Journal*, and also appears, on a smaller scale and in one sheet, in the *Bulletin* of the American Geographical Society for May. This river has been many-named. Its lower course was formerly known to the rubber men as the Ariquana. While the river as a whole was still in the speculative stage it was called the Rio da Dúvida (River of Doubt). In the course of the recent expedition Colonel Rondon, acting on authority received from the Brazilian government before his departure, named it the Rio Roosevelt, but subsequently this was changed by the government to Rio Theodoro, which is an easier name for Brazilians to pronounce. The Spanish form, Rio Téodoro, which appears on some of the maps in Mr. Roosevelt's book and in other publications, is erroneous.

**European Weather Reports** have been generally curtailed or suppressed altogether during the present war. Apart from the fact that forecasters have been hampered by the suspension of telegraphic communication between mutually hostile countries, the fear of publishing meteorological information that might be useful to the enemy has led to the practice of delaying the issue of weather maps and bulletins until they have lost all value for practical purposes. Thus the French daily weather map is issued a week after the date to which it refers. Since the first of May the British Meteorological Office has ceased to issue any forecasts except those relating to spells of fine weather, which are telegraphed to agriculturists at the expense of the latter and are known as harvest weather forecasts. No forecasts are now issued to the newspapers. At the beginning of the war the newspaper weather charts were discontinued, and some months ago all references to the movements of barometric depressions and to winds were eliminated from the daily weather forecasts. All of which is a sad contrast to the hopes which were entertained of introducing great improvements in the European weather maps and reports in the year 1915, in accordance with a plan for uniform hours of observation and other reforms, proposed a couple of years ago by the director of the Russian meteorological service.

**Death Camas Poisoning.**—According to a bulletin recently published by the Department of Agriculture, one of the most serious sources of loss to sheep owners in the Western States, especially Wyoming and Montana, is *Zygadenus* (of several species) or death camas; also known under various other popular names, including such preposterous misnomers as "lobelia," "wild onion," and "water lily." Strange to say, a great many sheep owners do not know the plant, and ascribe the poisoning it produces to other causes. Thus lupines have been blamed for many cases of *Zygadenus* poisoning. It is said that in 1909 about 20,000 sheep were killed by this plant in a single county of Wyoming. Other animals seem less susceptible to its effects, though horses, cattle and human beings are made ill by it, sometimes with fatal results. Coville has reported that one species is sometimes used by medicine men of the Klamath Indians, mixed with the dried root of *iris missouriensis* and a little tobacco, to give a person a severe nausea, in order to secure a heavy fee for making him well again. The authors of the bulletin above mentioned report the results of elaborate experimental studies of this plant, extending over a period of five years. They are able to present a much more extensive account of the symptoms produced by the plant than has hitherto been available. Every effort was made to find some effective remedial treatment but without satisfactory results. Frequent doses of tannic acid or sodium bicarbonate aid in recovery, but the expense of such treatment is prohibitive, except when the animals are especially valuable. The only method of reducing losses appears to be to make the plant better known to shepherds, so that they will keep the animals away from it.

## Automobile

**Acetylene Tanks in Big Fire.**—Probably the most spectacular fire ever staged for the benefit of an awed and admiring populace, occurred in the first week of this month in one of the warehouses of a company making acetylene tanks, charged with gas under pressure. The fire started, it is said, from a defective electric insulation, and soon engulfed the whole building. When the heat reached a certain degree, the fuses in the tanks melted and the acetylene gas was released under great pressure, heightened by the heat. Nearly 8,000 tanks furnished sharp hissing streams of acetylene gas, which burned with such a fierce bright flame that nobody could look toward the fire without using smoked glasses. To try to extinguish such a blaze with water was of course useless, and the great quantity of stored acetylene had to burn itself out.

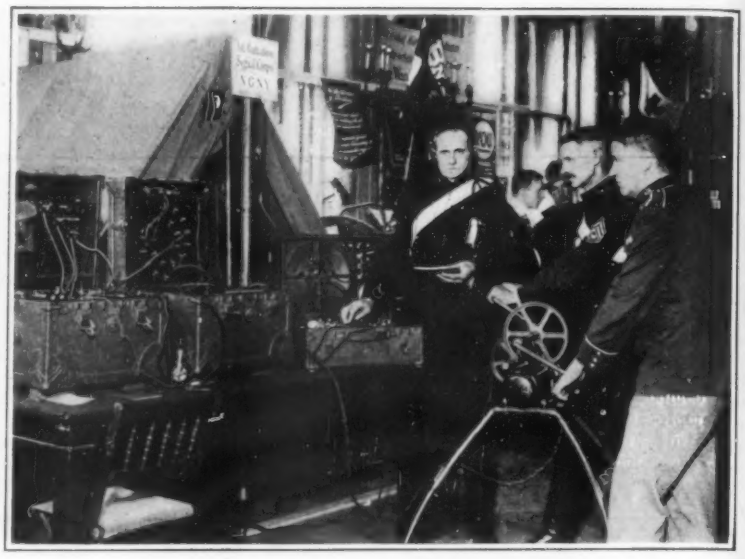
**Artificial Leather to the Fore.**—The extraordinary increase of the number of motor cars has had a peculiar influence upon the artificial leather industry. While not so long ago "artificial" leather was marketed under names suggesting "leather," and as a sort of apology for the "real thing," its extensive use on automobile tops, automobile upholstery and tool bags, has caused the manufacturers to openly boast of the fact that their product *is artificial!* The reason for this change of heart is found in the custom of some upholstery makers of 'splitting" the cow-hides into several thicknesses, each of which is used as "leather." And the good service which the new watertight top-materials give, is gradually working a change in the motoring public, to the extent that many people deliberately ask for "artificial leather" tops and covers.

**Queer Causes of Carbonization.**—Practically every owner of a Ford car sooner or later will discover that the first cylinder of his car will carbonize more frequently and more quickly than the other three. For a long time this has been one of the mysteries of the Ford car, and much ingenuity was spent in trying to find the reason. A repair man recently proposed what seems to be the best and most logical answer to the problem: The Ford car has a transverse spring, which in the course of time begins to suffer compression. The front part of the motor therefore sinks slightly below the rear end and the oil in the crankcase flows forward, where it collects below the first cylinder. An excessive amount of lubricating oil is carried into the first cylinder, and carbonization results. As a remedy for this frequent trouble the discoverer suggests a raising of the motor in front by means of a small wooden block.

**$1,180,000,000 in 1915.**—On June 1st, of the present year, the number of automobiles in the United States for the first time reached 2,000,000. Figuring on an average of four persons to each car, which is very conservative, there are 8,000,000 people in this country in daily enjoyment of motoring. What it costs to follow this sport is of interest, because of the stupendous figures involved. To run 2,000,000 cars for one year requires at the very least 1,000,000,000 (one billion) gallons of "gas," worth $130,000,000; 20,000,000 gallons of lubricating oil, worth $8,000,000; 12,000,000 tires, worth not less than $16 a piece, or $192,000,000; accessories and extra comforts, goggles, gloves and caps, at $50 per car equals $100,000,000; garage charges on short tours (exclusive of gas and oil) $100 per car per year, $200,000,000; repairs made necessary by wear, tear and accident (exclusive of tires) $50 per car per year equals $100,000,000. Total running expenses for all cars in use, $730,000,000. Add thereto the value of the 600,000 new cars purchased during the year, at an average price of $750 equals $450,000,000, we get the immense total of $1,180,000,000 spent in a single year (1915) on the sport of motoring.

**Germany's War Car Problem.**—As in many other things connected with the war, Germany's exactness and preparation is first in the field to solve the problem of the used "war car," which looms threatening in the distance. Great Britain and France realize the seriousness of the matter, but so far have not taken a single step to control it. Germany, however, has already made preparations to handle the delicate situation effectively, the moment the war stops. A company has been formed, in which the government and the motor car manufacturers are interested, which company will take over all the cars used in the war, which are capable of repair. They will be put in first-class running condition, and then offered to the public at a reasonable price. Only one third of the total will be placed on the market in the first year, one third in the second year and the remainder in the third year. In the meantime manufacturers of new cars will be able to introduce their product, knowing exactly how many cars, and of what price and condition, will be offered in the second-hand market during a certain time, and can plan their manufacturing and sales campaign accordingly. If, for instance, a certain type of car is especially numerous in the used-car field, manufacturers will "go light" on that type. By such means it is hoped to control the situation and prevent a flood of poor, used cars, at ridiculously low prices.

Loading an army 3-inch field gun.



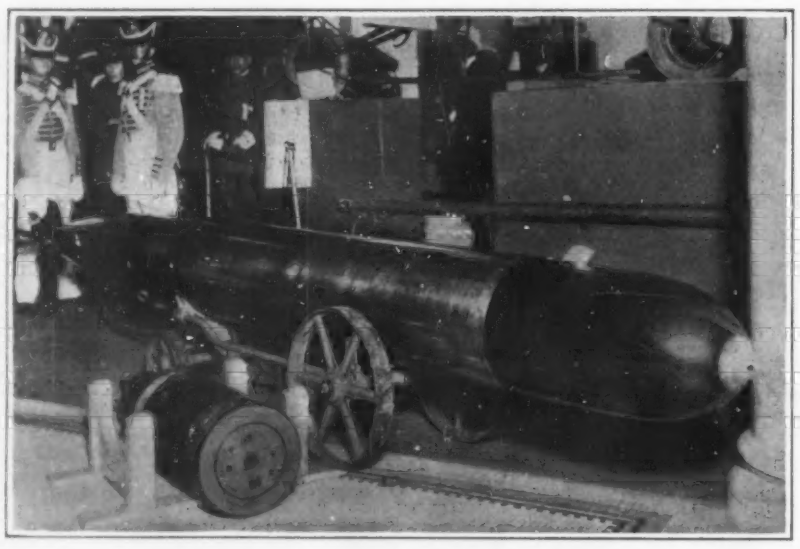
A field radio set with hand-driven generators.

# The Naval and Military Exhibit of the National Security League

## Weapons of Defense for Safeguarding the United States Against Attack

As part of the programme of education of the general public now being carried on by the National Security League, an exhibit was held in New York at the Astor Hotel of some of the very latest naval and military material with which our forces are equipped. We present illustrations of some of the more notable exhibits. Foremost among these was one of our latest 21-inch torpedoes, a weapon which is capable of a speed of 40 knots and has a range of over 7,000 yards. The label stated that the torpedo costs about $7,000, and takes about one year to build; but, as a matter of fact, it is possible to build these in considerably less time if the factories are pushed to their full capacity. Alongside of the torpedo was a 14-inch shell, of the type used in our new naval 14-inch guns. This shell weighs 1,400 pounds, and it is fired with an initial velocity of 2,600 feet a second and an initial muzzle energy of about 65,000 foot-tons. It is capable of penetrating 16 inches of Krupp armor at a range of 10,000 yards, and its maximum range is about twelve miles.

The new army air-cooled machine gun.

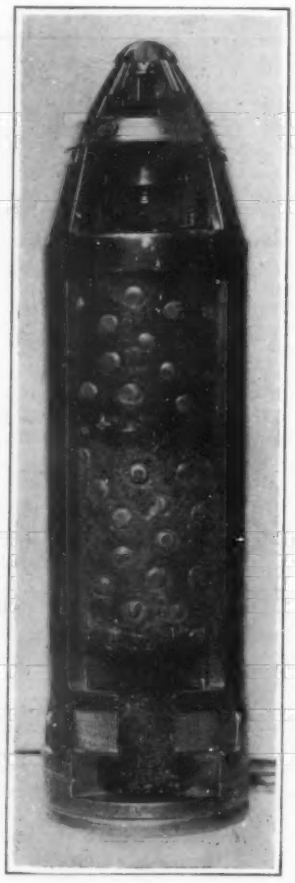


A 21-inch torpedo and a naval 14-inch shell.

An exhibit which attracted great attention was that of a 3 inch field gun, the type of weapon which has done such effective work during the present war. The accuracy and rapidity of fire of this gun is due to its mounting and excellent sighting devices. The gun recoils in a sleeve which is attached to the gun carriage. The advantage of this is that it is not necessary to readjust the carriage after each round has been fired, the carriage being maintained in position by a deep spade at the after end of the trail, and by the use of brakes on the wheels. The readjustment in elevation is made by an elevating screw, and an important improvement is the introduction of devices whereby the gun itself can be moved in azimuth, or in a horizontal plane, independently of the gun carriage. The bore of the gun is 3 inches, and it fires a 15-pound projectile, which may be either a percussion shell or a shrapnel shell, according to the nature of the attack. There was on exhibition a shrapnel shell, with part of the casing cut away to show the way in which the balls are assembled. The walls of the shell are thin so as to admit of easy and complete fracture, and the shell is burst and the bullets are liberated by a small charge of black powder at the base of the shell. When the shell bursts, the bullets fly forward with the velocity of the shell at the time of bursting, and they are scattered in a wide cone of dispersion.

Another exhibit was the new type of air-cooled machine gun adopted by our army, which dispenses with the rather cumbersome water-jacket of the ordinary Maxim type. The piece is light and is capable of firing several hundred shots per minute, the ammunition being carried in a belt which is fed laterally at the breech of the gun. The ejection of the shell, introduction of the new cartridge and all the operations connected with firing are performed automatically.

Not much has been heard during the present war of one of the most important branches of the service, the Signal Corps, upon whose efficiency depends the ability of the commander-in-chief and the subordinate generals to co-ordinate all the complex movements of the great armies under their command. The Signal Corps had loaned for exhibit a field radio set, one of the interesting features of which was a small generator for furnishing the necessary current, operated by hand-power through a couple of crank handles and set of intermediate speeding-up gears. The crowded condition of the room in which this exhibit was held was one among many evidences of the widespread public interest in the matter of our national defenses which is finding expression in the activities of the National Security League, in the Navy League, the American Legion and other movements to induce Congress to take up the matter of our national defenses in a rational, non-political and thoroughly national spirit.



Shrapnel shell in section.

**"Kewpie" as a Trademark.**—Rose O'Neill Wilson filed an opposition to the application of William Hecht for registration of the word "Kewpie" as a trademark for children's clothes. The Commissioner of Patents granted Hecht's motion to dismiss and appeal was filed to the Court of Appeals of the District of Columbia, which sustained the Commissioner's decision saying, "It is unnecessary to consider in how far the name Kewpie and the thing patented and copyrighted are equivalent or in how far a "Kewpie" may be applied to goods of the same descriptive properties since opposer is not in a position to object to the trademark use of the word by applicant. "Before opposer can be heard, therefore, it must appear that she had used the figure or word "Kewpie" as a trademark on goods of the same descriptive properties as the goods of applicant to which the mark is applied and at a date prior to its use by applicant. In this she totally fails."

# The Aeronautic Lessons of the European War

## In This Experimental Air-War the Brilliancy of the Celtic Mind Has Scored Heavily

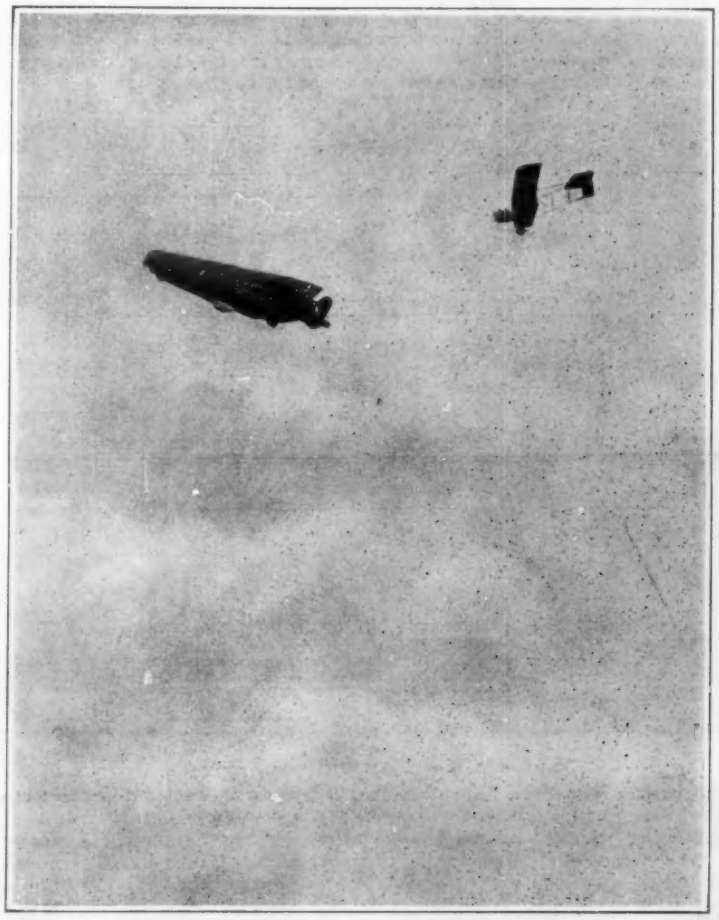
By C. Dienstbach

IT may already be safely said that the tremendous struggle now convulsing Europe will probably result in a complete modification of the military aeronautic conceptions that prevailed before the fatal August of 1914. All published reports show conclusively that lessons are learned each day which throw light on the hypothetical surmises of peace. Clearly this air-war is waged on a tremendous scale. The men and apparatus engaged number thousands. Contrary to the experiences and teachings of the Morocco and Balkan campaigns, there is no lack of enterprise in making the most daring experiments.

In discussing what has so far been learned, the strange transformation of news service since August, 1914, must be duly considered. Apart from such delightful fiction as Garros's alleged self-sacrifice, there is enough to bewilder in the most official reports. It was certainly refreshing when recently the British press relieved the endless monotony of "columns of fire rising from hit magazines" (one side), "no damage done" (other side), by the statement that henceforth nothing would be published about the effect of aerial bombardments. While news dispatches have thus to be taken with more than the proverbial grain of salt, the great mass of conflicting evidence may reasonably be worked into a sort of mental composite photograph and some conclusions drawn. It seems certain that aeronautic science *per se* has greatly profited. The courage required in running aircraft seems little compared with the demands made on every private in battle. Such are the *sangfroid* and equanimity of pilots in dealing with the dangers of the air that a military aviator who is a victim of an aviation accident is now a rare bird, although flying in winds against which modern speedy planes hardly make headway, is now common practice, indeed. Increased boldness, not as formerly in winning applause, but in striving for results, also demonstrated such feats of navigation as British aeroplanes finding their way to Cologne and Friedrichshafen over hostile territory, and Zeppelins unfailingly locating darkened English cities. In time of peace it seemed improbable that unsteady aeroplanes would run the risk of attacking each other. Now attack seems simple in the glare of actual war. As the spectacle of universal death has evidently wiped all fear from the consciousness of war aviators, they no more shrink from an aerial encounter than from a horseback fight.

About this actual war in the air, we are already in possession of much enlightening information. As predicted in these columns, air combats are decided with firearms. The former French assumption of hawklike tactics in trying to overmount one another has not thus far been realized. On the contrary, machines at the supreme moment have been saved from bullets by being dropped like a stone to lower levels. The encounters rather resemble those between horsemen, except in not being confined to one level. Long range shots are not resorted to and automatic pistols and carbines rank with machine rifles on aeroplanes (all as predicted in the SCIENTIFIC AMERICAN time and time again). Fast maneuvering for a lucky shot at close quarters handicaps machine rifles, which cannot be aimed as freely in any direction and which also require heavier and more sluggish planes to carry their weight. For the same reason it is not astonishing if, according to the tenor of the reports, German machines often get worsted in these combats. Neither side had adequately prepared for them. The Germans now suffer from having misinterpreted the aerial experiences of the Moroccan and Balkan campaigns and for not having fully appreciated the possibilities of the aeroplane as a fighting machine. Aeroplane duels were not on its programme, because the hired civilian flyers of the Bulgars and Turks did not care to risk their lives in such performances. Interpreting the experiences of the Balkan war too strictly, the Germans developed what they considered ideal scouting machines for war service—very stable, easy to fly, with unfailing motors, very solidly built so as to withstand rough handling, but heavy and comparatively slow. They were also too highly standardized, so to speak, in weight and dimensions. The French equipment remained more experimental, of greater variety, and more adaptable to the novel conditions which developed when true soldiers manned the apparatus. (This German policy seems an exact parallel to their equipping slow battleships with many small guns after the—in the light of dreadnought development—equally inconclusive battle at the Yalu.)

The British, similarly equipped, must be credited with true progressive spirit in dealing with the aeroplane. They made it at once the rule to block the air to hostile craft. In this the French were their apt pupils. As the best information may at present be gleaned from accounts so humble and indirect as to escape the censor's attention, much can be guessed from the description of a Berlin journalist's uneventful visit to a German flying camp in Poland. He casually mentions how



Courtesy of *Illustrated London News.*

**A Zeppelin pursued by a French biplane.**

elated were German aviators who had been recently transferred from the western to the eastern front because of the cessation of the eternal interference by the enemies' flyers with their scouting.

The combat in the air has evidently come to stay, but it seems at present in much the same shape as would be the naval warfare of a half civilized country with some battleships, cruisers, and destroyers with navigators but without any trained fighters. Only rough-and-tumble encounters appear to have as yet taken place in the air; the account of a German biplane's victorious escape from a flock of large and small French machines which attacked it from all sides, forcibly reminding one of schoolboy days—of instinctive dodging and wriggling and naturalistic striking. Not only must tactics of air fighting be definitely formulated, but proper types of fighting craft must be decided upon. On the sea continuous scouting and raiding without a decisive general engagement would be inconceivable. Only in the old days when merchantmen with crossbows and hand guns constituted the navies of northern Europe, naval engagements seem to have resembled our aerial duels.

Allied aeroplanes are, as a rule, higher powered for their weight than the German machines, and the fact that they renounce automatic stability of form tends to a further increase of speed and maneuvering and climbing ability. This makes them decidedly the superior fighters. Aerial fighting would change its known aspect if any information were forthcoming about the effect of Zeppelin guns beyond the statement that they brought down British seaplanes over the North Sea. Dirigible fire is essentially different from aeroplane fire; there is no difficulty from vibration or swaying of the platform; the pieces have a perfectly clear arc of fire fore and aft, and the gunnery service is complete and perfect. This permits of longer ranges. The superiority in air combat of even the smallest explosive shell over the bullet has also been conclusively demonstrated, because aeroplanes were riddled into sieves by machine guns and yet escaped because they contain so few parts, and these are frequently armored where a small bullet hole might be fatal. Explosive (percussion) shells, even smaller than those that have been fired by Zeppelins, would, on the contrary, be most efficient against the structure of an aeroplane under the strain of flying.

A gunner of Nelson's days, trained for the destruction of sails and spars, would have been equipped to advise which of our weapons we might best use against aeroplanes. Experience so far has taught about this new ("lost") art that it takes two bullet holes in closest proximity to break a strut. Fuses have been demonstrated which explode a shell even if it hits only the cloth covering of a wing, with the inevitable result that vital parts of the frame are smashed. A cannon's slower rate of fire is thus considerably more than offset by the enormous increase of vital target area resulting from the use of shells. The Germans seem handicapped by the fact that to be the pioneers in a new field has often not proved to be their "*forte*." They prefer to wait and improve on the experiments of others, but it is this time, *hic Rodus, hic salta.*

In this experimental air-war the brilliancy of the Celtic mind has scored heavily. The recent destruction of a Zeppelin by a light high-powered French monoplane, piloted by a daredevil Canadian, who barely escaped being hoisted by his own petard, is a striking instance. The writer pointed in these columns to such a danger in the beginning of the war, reminding readers of the SCIENTIFIC AMERICAN that Germany possessed some identical small, powerful machines in addition to the comparatively clumsy standard type, to convoy and protect Zeppelins, also for fighting hostile aeroplanes. From the accounts it also appears that this Zeppelin carried only a machine rifle, leaving behind its cannon, and it seems more than doubtful whether the latter was so mounted as to sight with ease and quickness vertically at a bomb-dropping aeroplane.

Evidently this Zeppelin succumbed to what has so far proved the most deadly sort of aerial attack—swooping like a hawk with a racing machine and throwing bombs at so close a range that they cannot miss (the writer advocated this five years ago in the *Century Magazine*). These tactics had often proved their value against the ground; high up in the air they are still easier, because the sweep may there be continued past its objective. A light shell-firing, semi-automatic cannon so mounted that it may be brought to bear as instantaneously as a rifle and with a perfectly clear arc of fire in any direction (as it enjoys atop a Zeppelin) will defeat it. A machine gun might turn a swooper into a sieve and yet never ward it off; one hit with a shell at any part of its structure will surely sway it from its path and precipitate it to the ground.

Much must have been learned about bomb dropping in this war, but all we know so far is that it is lavishly indulged in. Reports about its efficiency are so utterly conflicting and information about the methods of aiming so lacking that it is hard to draw any conclusions. The most recent fashion to attack in great numbers deserves credit as the beginning of naval tactics. They have escaped the enemy's guns as luckily as did the Zeppelins, though collectively offering a larger target. The value of aerial scouting, also especially for range-correcting, has of course been paramount. The

*(Concluded on page 636.)*

# The Strategic Moves of the War

### By Our Military Expert—June 17th, 1915

DURING the week ending June 17th, 1915, the strategical and tactical moves on the vast European battlefield that have received most attention have nearly all taken place in the eastern and Italian regions. Little or nothing has occurred to indicate that the Germans have abandoned or even materially weakened their offensive campaign against the Russians. On the contrary, the lack of powerful opposition to the Italian advance, the comparative inactivity of the Germans in the eastern theater, and the renewal of active operations in Galicia, all point to a determination on the part of the Teuton allies to follow up the advantage they have gained over the Russians as a result of the decisive operations during the month of May.

Przemysl was captured from the Russians on June 3rd, after a month of the fiercest and most continuous fighting of the war. Both sides must have been practically exhausted. Doubtless the wounded received only such treatment as could be given them in field hospitals. There probably was no opportunity to send them to base hospitals in the rear, for the railroads were taxed beyond their capacity to supply food and ammunition to those able to fight. In war, human life must ever be a consideration secondary to the winning of battles. The Russians were greatly hampered by the confusion and disorganization of retreat and the Germans were employing every available resource to gather the greatest possible harvest from their victory. Decisive victories are won not by breaking through a line or turning a flank, but by the destruction that attends the pursuit of a routed army. But there is a limit beyond which even a pursuing victorious army cannot go, and the Germans apparently reached that limit with the capture of Przemysl, and more than a week of comparative quiet followed.

This period no doubt has been used by both sides in restoring their organization, bringing up reinforcements, replenishing food, ammunition and other supplies, sending the wounded to hospitals at home, and the shifting of portions of the armies to the positions they were to occupy preliminary to the next move. Speed and precision count in these matters the same as on the battlefield, for the side first ready to start afresh has a decided advantage. In the absence of strong reinforcements for the Russians it was to be supposed that the victorious Germans would recover more quickly than the defeated Russians, and this appears to have been what happened.

Viewed from a broad strategic standpoint, the Russians endeavored to cover the retreat of their right and center, which received the full force of the German blow, by a most persistent and vigorous offensive against the German right wing to the eastward in Bukowina. They met with some success here on the Pruth and Dniester rivers, but the danger to the Germans was not so great as to lead them to weaken their driving force in Galicia through fear of disaster to their right in Bukowina. In the end the Russians withdrew this portion of their line to the Dniester, where they blocked the further advance of the Austrians until about June 13th. In the surprisingly short period of ten days (from June 3rd to June 13th) the Germans were able to resupply themselves sufficiently to enable them again to advance in force on a front of about forty miles. They defeated the forces opposed to them, captured many prisoners and made a further material advance on Lemberg, the capital of Galicia and immediate prize for which they are fighting.

The real objective of the German army is not cities or fortresses, however, or even the recovery of Galicia, but the total overthrow of the Russian army. Stupendous as this task may be, still its successful accomplishment may be well within the limits of the German hopes and ambition. The Russian army probably is not in the desperate condition stated in many of the reports from the seat of war, due to the shortage of arms, ammunition and trained men, but if by any chance the shortage exists, this combined with the loss of *morale* incident to the disastrous defeats in Galicia, would be more than sufficient to call forth the Germans' supreme effort. If the Teutons are still hoping to win the war and not merely struggling for an advantageous termination of the war, the destruction of the Russian army is a certain means to this end, if it is not the only means. But an army of this magnitude with a vast country behind it cannot be destroyed in a day, and it is reasonable to expect that Russia will supply her deficiencies long before any such decisive and unprecedented disaster could occur.

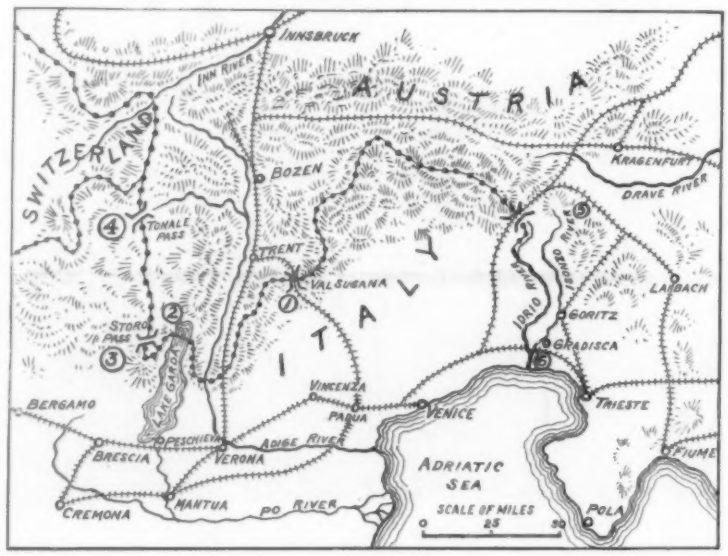
The continued inactivity of the Allies in the west is difficult to understand. There has been daily fighting, to be sure, in this field, particularly at the northern end of the line, but it is fairly devoid of results and has no decisive effect on the general war situation. At no other time since the early weeks of the war, when Paris was saved, has there been a situation so clearly demanding the full offensive efforts of the French, English, and Belgians. Russia is desperately in need of the assistance the western Allies might give her by a drive against the German line in the west, so powerful that Germany would have to abandon her campaign against Russia in order to hold her line in France. Instead, the Allies have continued their policy of "nibbling," which, by the way, seems to be the French translation of "watchful waiting." The Germans also have taken a "nibble" in this theater during the week and, despite the demands made upon them in Russia and elsewhere, have developed sufficient strength in the west to recapture part of the Souchez trenches. We may well ask how long Russia will bear the brunt of the hard fighting without complaining, and whether a small germ of dissatisfaction if once planted might not become in time a menace to concord and unity of action among the Allies.

Italy has continued her methodical advance into Austria along two lines as shown on the map—one force moving into the Trentino on the front (1), (2), (3) (4), and the other moving to the east against Trieste on the front (5), (6). The censorship on reports from Italy has been very strict and little is positively known regarding the strength of the two advancing Italian armies and the opposition they have encountered. Those who hoped for something spectacular to follow Italy's entering the conflict have been disappointed, but there is no good reason why the Allies should be dissatisfied with the progress made by Italy. She took the offensive at the outset, forced Austria to play to her lead, and while she has not pushed far into Austrian territory, she has at least done her fighting on foreign soil and has met with no reverse.

A glance at the map shows the strategic disadvantages of Italy. Whether she advances into Austria by the eastern or northern route, the flank of the invading force and its lines of communications are exposed and must be protected. The left flank of the force advancing on Trieste is, and the railroads in its rear are, open to attack by an Austrian force coming from the north. Similarly, the right flank and the communications of the Italian army advancing to the north on Trent may be struck by an Austrian army coming from the east. These conditions compel Italy to operate in both directions, each of her two armies being a covering force for the other, but under the tremendous strategic disadvantage of becoming more widely separated the farther they advance. It seems highly improbable that Italy will undertake major operations in both directions. Events to date indicate an advance in great strength on Trieste, accompanied by a minor movement toward Trent, the principal purpose of which is to protect the eastern force. Austrian resistance to Italy's advance appears to have hardened, particularly toward Trieste. But the fortress of Trent and the Alps are still Austria's main defense in Trentino.

The principal immediate advantage the Allies could expect to gain as a result of Italy entering the war was a lessening of the pressure on Russia. The continued success of the German campaign in Galicia indicates that the Austrians have refused to strengthen their forces on the Italian frontier at the expense of weakening their armies operating against Russia. It is possible they will go to the extreme of allowing the Italian army to overrun the Trentino and the region of Trieste while they concentrate their entire efforts on the destruction of the Russian army, for with Russia out of the conflict the recovery of lost ground on the Italian frontier would be a comparatively easy task. Besides, if the Allies win, Italy will get the Trentino and Trieste in the final settlement. More probably Austrian opposition to Italy will be greatly strengthened in the immediate future.

The week has produced no material change in the Dardanelles. Both forces are strongly intrenched on short lines with their flanks securely protected by the neighboring waters. This is siege warfare pure and simple and progress must be slow. If the Turks are eventually driven from their present position, and do not quit, they will have plenty of room in their rear for a second stand. The prospects are not good for decisive results here in the near future.




**Map of Italian theaters of war.**

One Italian army of invasion is on the lines 1, 2, 3, and 4. Another Italian army of invasion is on the lines 5 and 6.

## The Current Supplement

ONE of the timely articles in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2060, for June 26th, 1915, is an extremely interesting description of the methods of forging shrapnel shells by means of powerful hydraulic presses, involving features that are not generally known. The article on Mobile Colors, which was announced for the last issue, was unavoidably postponed, but will appear in this number, and will be found well worth reading. So many people are interested in automobiles that the important question of the proper lubricants to be used and the methods of using them will appeal to a wide circle of readers, as proper lubrication is a vital matter in the successful and efficient operation of these indispensable machines. It tells how various lubricants can be tested for quality and gives much information as to their constituents. There have been a number of statements in regard to the process of plating objects by a spray of metal, and the description of a process by an American inventor in this issue adds greatly to the information on this subject. Two fine illustrations and a brief description tell the story of a large gas engine built for blowing air in iron and steel furnaces. The exhaustive article on the Chemical Industries of Germany is concluded in this issue. An article of real practical value treats of the Construction of Floor Surfaces in Fireproof Buildings; and there is the usual variety of informative matter in shorter form. This issue is also indispensable, as it contains the Index covering the issues of the past six months.

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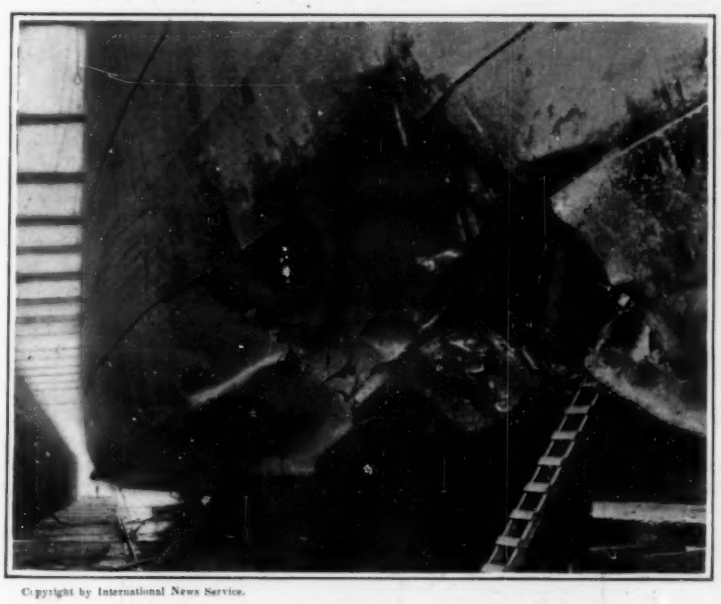
**Wanted—a New Solid Tire.**—One of the lessons learned in the European war has been the fact that a new type of truck tire is absolutely necessary. While in ordinary street service and on country roads in peace times the standard solid truck tire is fairly effective and reliable, it has shown many defects in the terrific driving strains of war service. It has been shown, for instance, that no matter how well made a tire is, it will separate at the point of contact between the soft rubber and the hard rubber parts. The hard rubber base, used in the majority of truck tires, has a different coefficient of heat and friction from the soft rubber section. In hard service, particularly when driving over Belgian block pavements, the two sections of the tire will come apart, and sometimes strip off suddenly under a particularly heavy strain. On a few occasions such accidents have proved exceedingly expensive, one truck carrying shells being completely wrecked while traveling at high speed over the *pavé*. Tests are now carried on in several tire factories with the idea of evolving a truck tire in which the soft rubber merges gradually into the hard rubber base.

### The Damage to the American Ship "Nebraskan"

THE torpedoing (if such it was) of the American freight ship "Nebraskan" forty miles off the southwest coast of Ireland, occurred at dusk and shortly after the ship had taken in the American flag which had been flying at her stern. The presumption is that, in view of the activity of German submarines in this locality, notably in the case of the sinking of the "Lusitania," the ship must have suffered the damage shown in the accompanying illustration as the result of deliberate submarine torpedo attack. As will be seen from the photograph, she received the blow well below the waterline and on the starboard bow. It was because she was struck so far forward, where the compartments are small and the subsequent flooding was comparatively limited, that the ship was able to be taken into port and placed in drydock. The German government professes to have received no report from any submarine commander, or any other source, of any attack on this ship; but in view of the lack of veracity of such official statements, notably in the case of the "Lusitania," this evidence carries practically no weight. It has been suggested that she may have struck a drifting mine; but if this had been the case, the blow would have been at the waterline. At the present writing, dispatches from the other side state that fragments of metal have been forwarded from our embassy which indicate that it was a torpedo which did the damage. The ship was subjected to a thorough expert examination by one of the naval constructors of the United States Navy, and it will be necessary to await his report on the subject before forming a final and positive conclusion as to whether the damage to the American ship was accidental or deliberate.



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**Bow of the "Nebraskan," showing damage wrought, supposedly by a submarine torpedo.**

### A Serious Interruption

THE Commissioner of Patents has, under date of June 10th, 1915, published a notice to the effect that, on account of the unusually large number of patents issued during the current fiscal year, the regular appropriation of $440,000 for printing patent specifications and the *Official Gazette* of the Patent Office, and the supplemental appropriation of $125,000, have been nearly exhausted, and that it will therefore be impossible to issue the *Gazette* for June 15th, 22nd and 29th, on those dates. The notice goes on to state that the issues referred to will be sent out as early in July as the publication can be effected, and that owing to the resulting congestion there probably will be some delay in the issues of the *Gazette* for July until conditions in the office of the Public Printer again become normal. It is to be greatly regretted that such a situation can obtain, notwithstanding that, as Commissioner Ewing says, there will be no delay in the issues of patents, designs, or trade-marks. It would seem that so important a branch of our Government as the Patent Office, particularly in view of the fact that it is more than self-supporting, should not be hampered, in even the slightest degree, by too strict a spirit of economy on the part of Congress, or for lack of foresight in providing the necessary appropriation for carrying on the details of its work. The *Official Gazette* is an exceeding important publication and is of interest and real need to a large number of our citizens. Certainly every effort should be made to avoid hereafter any such interruption in the publication of that organ. The regular issuance of the *Gazette* is especially important in connection with trade-marks, as all applications for trade-mark registration which have been passed by the Patent Office are published in the *Gazette* for a period of thirty days, during which period such applications may be opposed by interested parties, and for this, if for no other reason, any delay in the publication of the *Gazette* should be obviated.

### Shooting Spectacles*

THE eyesight of soldiers and sailors is often injured, temporarily or permanently, by direct or reflected sunlight. The injury is caused chiefly by the invisible ultra-violet rays, which are absorbed by the tissues of the eye.

In the outer parts of the eye these rays cause disagreeable sensations, which are commonly included in the term fatigue. The eyelids become heavy and red, tears flow, and there is a sensation of pressure, itching and burning. Long continued or repeated exposures to the sun's rays may produce catarrh of the conjunctiva. In extreme cases, occurring in mountain climbing, polar exploration and balloon flights, the acute inflammation known as snow blindness is observed. This ocular inflammation is closely connected with the "glacier-burn," which is also produced by the ultra-violet rays. On several occasions the movement of armies over snow-clad mountain passes has been impeded chiefly by these effects of sunlight.

When ultra-violet rays penetrate more deeply into the eye, they evoke fluorescence in the lens and the retina. The glow-worm light thus produced in the eye itself spreads a haze or fog over external objects in the field of view. The small proportion of ultra-violet rays that reaches the retina diminishes the ability to see in dim light.

Hence the exclusion of these injurious rays from the eye is very desirable, especially for riflemen and gunners. The newly invented greenish-yellow "euphos" glass absorbs the ultra-violet rays, together with part of the blue and violet rays, which contribute to the injurious effects above described, but freely transmits the rays that are useful for vision. The partial exclusion of the blue and violet rays presents another advantage in twilight, as it makes the blue evening clouds darker and gives prominence to objects of red and yellow tints.

I have often used these euphos glass spectacles in target practice on sunny days, to the great improvement of my marksmanship. I have also repeatedly employed them at sea, as a protection from the glare of the sun on the water. In particular, I have observed vessels immersed in this glare at the horizon and have made out many details which I could not distinguish with the unprotected eye. I have observed in this way for hours without experiencing any unpleasant sensations. Dr. Gross, who has had similar experience, says that the euphos spectacles diminish the width of the dazzling bright strips of water, sharpen the outlines of vessels and other objects at the horizon in the illuminated area, and are very useful in observing and aiming in the presence of searchlights.

Major Meyer, viewing the receding coast from the stern of an outgoing vessel, with the sun directly astern, observed with the naked eye a dazzling gap in the coast line, which closed up when the euphos glasses were used. Dr. Flemming wore light euphos glasses in a balloon flight attaining an altitude of more than 26,000 feet and experienced no inconvenience, while his companion, who wore dark gray glasses, suffered severely. Amundsen took with him on his Antarctic expedition a large assortment of protective glasses, including two pairs of light euphos glasses. Amundsen and Hansen, who wore the euphos glasses, were the only members of the party that escaped snow blindness.

The theoretical expectations formed by the euphos glass have, therefore, been realized in practice. There is no better protection against snow bindness than spectacles of euphos glass, and their employment also produces a notable improvement in marksmanship.

* Adapted from Dr. Schanz's article in *Die Umschau*.

### Who Invented the Circular Saw?

SOME discussion of this subject has appeared in several British technical publications, and the claim is made that the circular saw was invented and used by a wood turner named Murray at Mansfield, England, about the year 1820. The first saw is described as having been about six inches in diameter, and was undoubtedly used on a wood turning lathe operated by water power. James Murray, the inventor, is said to have been the son of "Old Joe Murray," the favorite servant of Lord Byron.

## Correspondence

*[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]*

### Waterproofing Concrete

To the Editor of the SCIENTIFIC AMERICAN:

Two or three recipes have been published in your paper, at various times, for waterproofing concrete. There seems to be a good deal of popular misconception on this subject, and it has occurred to me that a few notes I have gathered on the subject during a number of years' experience superintending concrete work, might be of interest to your readers.

No concrete can be made entirely waterproof. The best concrete, if subjected to water under high heads, will leak considerably. And even under very low pressures there is leakage, though it is so slow that the water leaking away evaporates as fast as it leaks and leaves an apparently dry surface. But, for practical purposes, a 1:2:4 mix, if made of a medium consistency and thoroughly tamped in place, will be waterproof under small pressures, say up to 15 pounds to the square inch. The more thorough the ramming, the more nearly waterproof the concrete. I have seen one case in which the pneumatic rammer was used, where the concrete was sensibly waterproof under 40 pounds per square inch pressure, without any further treatment.

Various compounds of alum and lye or soap are often mixed with concrete, to increase its waterproofing. One of the best known of these was published in a recent number of the SCIENTIFIC AMERICAN. Add three fourths pound of dry powdered alum to each cubic foot of sand and dissolve three fourths pound of soap in each gallon of water. Use one part of cement to two parts of sand and four parts of gravel. But I question whether the gain made by this method is worth the extra trouble. The same result can be reached by washing the surface of the concrete on the water side with a wash of one part concentrated lye and two parts alum, dissolved in sixteen parts water. Two or three coats of this solution should be applied, allowing time for each coat to dry, before putting on the next. This method is much less troublesome than the previous method and gives results as good.

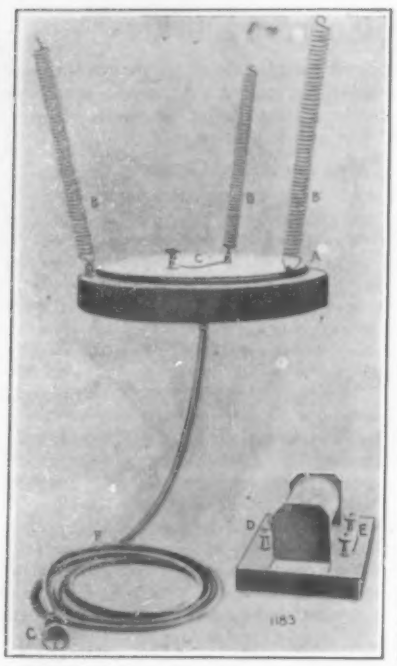
Another method in common use is to add from 5 to 10 per cent of hydrated lime to the cement before mixing, the proportions of mix being one part of the cement-lime mixture, two parts sand, and four parts gravel. This gives very good results, though it weakens the concrete slightly. On small jobs, where the cost is not of very great importance, a mixture of one part cement, one part of sand and two or three parts gravel, without any further treatment, is waterproof against moderately high pressures. The writer has seen one case, that of a pressure pipe line, where a 10-inch wall of this mixture was sensibly watertight against a pressure of about 65 pounds per square inch. But, in most cases, the cost of so rich a mixture is prohibitive.

Where concrete must be waterproofed against very high pressures, none of the above methods seems to be effective, and other means must generally be resorted to. The usual practice under these conditions is to coat the surface on the water side with asphalt, pitch, or alternate layers of pitch and tarred felt. Paraffine, melted and applied hot with a brush, has also been used very successfully, but this is rather costly where there is a large surface to be covered.

Seattle, Wash. LEO G. HALL, Civil Engineer.

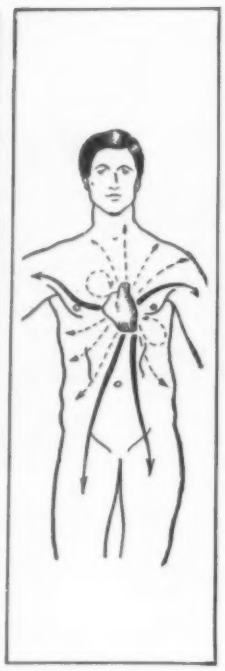
### The Engineering Foundation Organized

SOME months ago announcement was made of a gift of $250,000 by Ambrose Swasey of Cleveland, which was to be the nucleus of a fund to be devoted to research work in engineering lines and to the promotion of the interests of the engineering professions. No further contributions to the fund have been made, but the Engineering Foundation has been organized, at a recent meeting at the Engineering Societies Building, 29 West Thirty-ninth Street, New York, with the following officers: Gano Dunn, chairman; Edward D. Adams, vice-chairman; F. R. Hutton, secretary; and Joseph Struthers, treasurer. A large number of applications from those who desired the use of some of the funds for research work were already on file, but these will be held pending the filing of further specifications in accordance with forms to be drawn up by a committee appointed for the purpose.



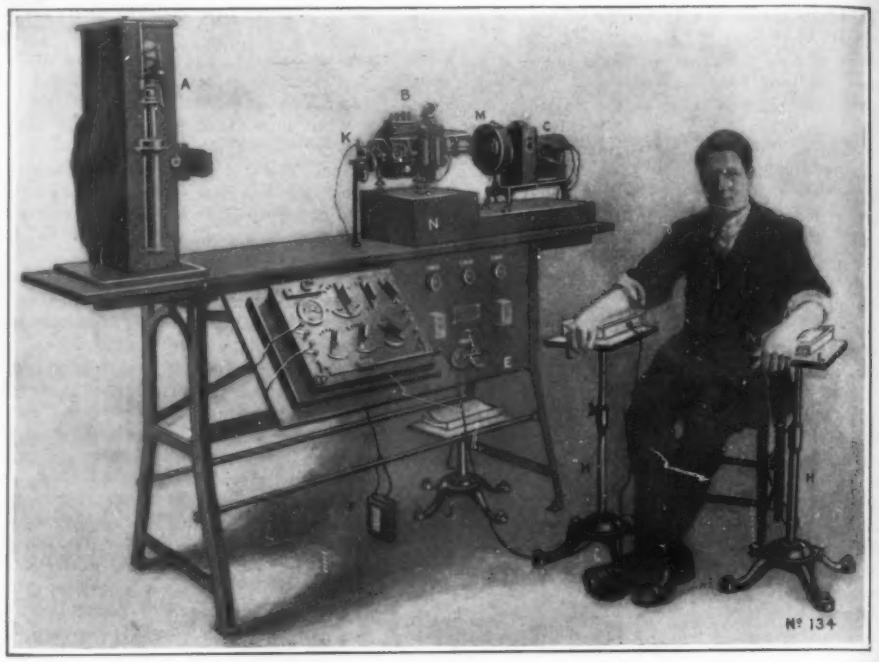
**Apparatus for phono-cardiography.**

*C*, microphone; *B*, *B*, *B*, spiral supporting springs; *G*, stethoscope; *D*, relay.



**Human power plant.**

Position of the heart and distribution of currents.



**Complete apparatus for electro-cardiography.**

*A*, camera; *B*, galvanometer; *C*, lamp; *D*, switchboard; *E*, keys, etc.; *F*, battery; *K*, chronographs; *L*, salt water baths used as electrodes; *M*, vessel of water for absorbing heat of rays.

# The Instrumental Study of the Heart

## Methods by Which Its Action and Condition Are Observed and Recorded

IT has long been known that every muscular contraction is accompanied by a difference of electric potential between the active, or contracting, part of the muscle and the passive part, so that, if the two parts are connected by a wire, a galvanometer interposed in the circuit will indicate the presence of an electric current.

The heart is a muscular organ and its rhythmical contractions, or beats, produce short-lived current which normally flows through the tissues of the body, but can be diverted to an external circuit. Currents were detected in the frog's heart by Koelliker and Mueller in 1856, but it was not until 1887 that Waller succeeded in recording human heart-beats on a photographic plate, with the aid of Lippman's capillary electrometer, and the first satisfactory electro-cardiograms were obtained by Bayliss and Starling in 1892.

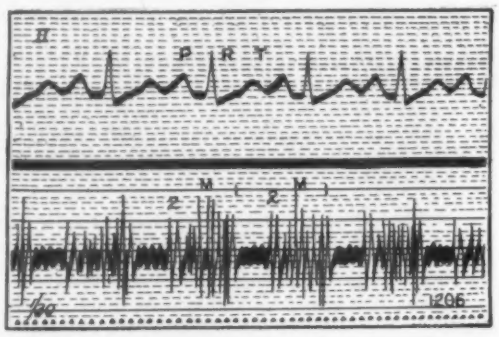
The development of electro-cardiography as a practical method of diagnosis began with the researches of Prof. Einthoven of Leyden, early in the present century, and his invention of an exceedingly sensitive instrument for measuring small currents—the Einthoven string galvanometer. In this instrument the current traverses a very fine and tightly stretched wire (or a silver-plated filament of glass), which passes vertically between the closely approximated poles of a powerful electromagnet. The part of the filament that crosses this strong magnetic field is displaced more or less to the right or left, according to the direction and strength of the current. The filament is illuminated by an arc lamp and condensing lens, and its shadow is thrown across a horizontal slit by a projecting microscope. A cylindrical lens forms on the photographic plate an image of the slit, in the form of a narrow bright band, on which the magnified shadow of the filament appears as a black dot. It is evident that if the plate is moved vertically with uniform speed the movements of the filament will be recorded in the form of a sinuous line.

In order to measure the movements, the cylindrical lens is engraved with equally-spaced vertical lines, which appear as fine horizontal lines in the cardiogram. The vertical lines of the record mark intervals of time, and are produced by momentarily interrupting the beam of light by the teeth of a uniformly rotating wheel.

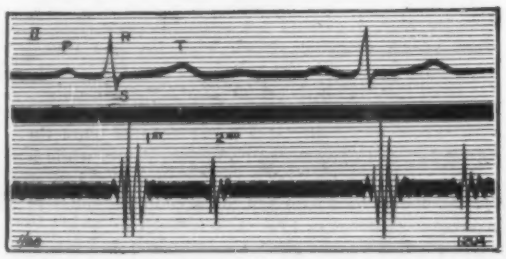
It is impossible to place wires directly in contact with a man's heart, and it is not necessary to do so, for the heart-currents permeate the whole body and may be taken off by connecting almost any two parts of its surface. In practice three circuits are used: Circuit I, from the right arm to the left arm; circuit II, from the right arm to the left leg; circuit III, from the left arm to the left leg.

The two selected limbs are connected through the galvanometer by immersing them in vessels of brine into which dip porous cups, filled with zinc sulphate solution, and containing the zinc terminals of the galvanometer wires. The glands of the skin produce a nearly constant current, which is called a "rest current" in contradistinction to the "action currents" caused by muscular contraction. This rest current must be compensated by an accumulator or otherwise. It is necessary, also, to standardize the apparatus, by means of a rheostat, so that a given electromotive force shall always produce the same deviation of the galvanometer filament and, consequently, the same elevation or depression in the sinuous line of the record.

The record may be made on a glass plate, which is attached to a hollow leaky piston plunging into a cylinder filled with oil, so that it descends with uniform speed by its own weight. It is better, however, to use a band of photographic paper or film moved uniformly by clockwork, or an electric motor.



**Electro-cardiogram (above) and phono-cardiogram (below) of a heart affected with mitral disease.**



**Electro-cardiogram (above) and phono-cardiogram (below) of normal heart.**

**Normal electro-cardiograms for the three circuits.**

Various forms of apparatus are used. The foregoing description applies chiefly to the apparatus which is now furnished by the Cambridge Scientific Instrument Company.

Hitherto, almost all electro-cardiograms have been made with the Einthoven string galvanometer, but the difficulty of managing the optical apparatus and regulating the tension of the filament has led Siemens and Halske to construct for this purpose a special form of the mirror galvanometer, which is used in physical laboratories. In this instrument the current to be measured traverses a coil of very fine wire delicately suspended between the poles of an electromagnet. The coil carries a little mirror which reflects a spot of light to the photographic film.

The contractions of the heart do not occur simultaneously in every part. They begin in the auricles, at the base of the heart, and thence spread through the ventricles, which occupy the greater part of the organ. Each complete cycle of the heart is represented in the electro-cardiogram by three elevations, separated by nearly level portions. The first elevation corresponds to the contraction of the auricles. The second and third elevations are produced by the progressive contraction of the ventricles, and the level line between them indicates, not a cessation of contraction, but the balancing of opposing electromotive forces in different parts. The second elevation is as high as the other two combined, and is usually preceded and followed by a slight depression.

The electro-cardiograms obtained from the three circuits (I, II and III) exhibit differences which are particularly important in the examination of a diseased heart. The same circuit is not the most useful for diagnosis in all cases.

The string galvanometer is also used, in connection with a microphone, to record the sounds of the heart. A phono-cardiogram and an electro-cardiogram can be made simultaneously by employing two galvanometers.

The sounds of the heart were registered, imperfectly, by Hurthle, by converging them through a stethoscope to a microphone connected with the primary coil of a transformer. The currents induced in the secondary coil were employed to produce contractions in a frog's leg, and these contractions were recorded by a myograph. Einthoven and others have employed a microphone connected with a telephone receiver, the vibrating membrane of which was attached, by a rod, to a slightly convex glass plate, in contact with a plane plate. The contraction and expansion of the Newton's rings thus produced were photographed on a band of paper.

The simpler and far superior string-galvanometer method employs a microphone mounted in a heavy iron ring, which is suspended horizontally by three spiral springs. The sounds of the heart are conveyed to the microphone by a stethoscope and a rubber tube. The microphone is connected with the primary coil of a transformer, whose secondary coil is connected with

the string galvanometer. The movements of the galvanometer filament are recorded in the manner already described.

The phono-cardiogram thus obtained shows oscillations, arranged in groups, which are nearly synchronous with the second and third elevations of the electro-cardiogram. These oscillations are especially intense and instructive in cases of valvular disease.

These new electrical methods of recording the contractions and the sounds of the heart possess the great advantage of applicability to patients at a distance. Einthoven, in his laboratory, made electro-cardiograms of patients in a hospital more than a mile away, and several great hospitals are now provided with electrical connections by which patients in the wards can be connected with electro-cardiographic apparatus situated in a special laboratory. In this way the patient is spared fatigue and the excitement caused by the sight of the apparatus, both of which are especially injurious and disturbing in heart disease. Before long, possibly, the public telephone system will be impressed into this service, and the eminent specialist, seated in his office, can examine the hearts of patients who remain in their distant homes.

Dr. Tussier, a collaborator of Dr. Carrel, recently described a bold and original attempt to treat valvular disease of the heart by surgical methods. While we admire the skill and daring manifested in this and similar surgical exploits, it is well to remember that they have been made possible by the researches of the infamous vivisectionists who are held up to the public execration by certain supersensitive souls. These researches have enabled us, not only to modify the natural conditions of the heart's action, but even to revive a heart that is apparently dead. This resurrection of the heart is shown in the following striking experiment.

A frog's heart is excised and, after it has ceased to beat, an artificial circulation is established in it, either with defibrinated blood, or with a wholly artificial serum. In a few seconds the heart begins to beat again. If the beats of this "isolated" heart are recorded on a rotating cylinder by appropriate mechanism the record shows that they exactly resemble the beats of a living frog's heart in rhythm, frequency and amplitude.

A highly refined and perfected apparatus of this kind devised by Pachon, shown in one of the accompanying illustrations, permits of the study of the effect of various solutions on the heart of a warm blooded animal. The heart is electrically stimulated and performs its functions as though in the body. The solutions are passed through the heart as is the blood when the heart is performing its offices in the living animal.

In this apparatus the arrangement of the two pressure tanks is particularly ingenious. The pulleys permit them to be raised and lowered as necessity demands and the connection of an air pipe from one tank to the other as well as the pipe through which the solution flows insures a practically uniform pressure.

An even temperature is maintained by heating the bath in the tank by means of gas burners which are directly beneath the bath chamber. The use of three jars in the bath chamber allows experimentation with as many solutions.

The manometer indicates the blood pressure. The apparatus to the extreme left records the heart beats with an ink pen on plain paper which surrounds the roll.

The electric battery with bell is connected with the electric thermostat and rings a bell if the temperature rises above or falls below a certain point. As an insurance against temperature changes the bath tank is built with two walls having an air space between them.

While there have been a number of clever mechanisms constructed during the past generation to promote the study of the vascular mechanism this one has been thought out with greater attention to detail than any hitherto known, and the result in control of pressure and temperature leaves little to be desired.

By gradually improving their methods physiologists have obtained the same result with isolated hearts of rabbits, dogs and other mammals, maintaining their functional activity for many hours.

This method has produced important practical results. It permits us to study the properties of the active cardiac muscle, which are very different from those of other muscles.

For example, the contraction of a skeletal muscle is proportional to the stimulus which evokes it, but the cardiac muscle contracts to its maximum extent or not at all. The method also facilitates the study of the factors that influence the heart's contractions (temperature, physical and chemical agents, etc.). By varying the composition of the irrigating serum different curves are obtained which indicate differences in the force, frequency and form of the contractions. This method is very valuable for the study of the effects of medicines upon the heart because, in the isolated heart, these effects are not masked by other physiological reactions, as they often are in the living subject. For example, the addition of a trace of chloroform to the irrigating serum stops the beating of the isolated heart instantly, and often permanently. This proves that chloroform is a heart-poison and explains the fatalities that occur in anesthesia produced by chloroform. Small doses of caffeine, on the contrary, augment the frequency and amplitude of the beats of the isolated heart, and digitaline increases the energy of its contractions.

These experiments are most successful when they are practised upon the isolated heart soon after its removal from the body, but they can be performed hours or even days after its excision. A dog's heart has been revived after four days, a rabbit's heart after five days, a tortoise's heart after eight days of isolation.

Can the same miracle be wrought upon the human heart? The heart of a beheaded criminal has been observed to beat spontaneously twenty-five minutes after decapitation, and it has been found possible to restore the heart's beating, by massage, forty minutes after it had stopped.

Improvements in the artificial circulation may enable us to revive the heart of a man as well as that of a dog.

The heart is not the only tissue that survives removal from the body. The muscles of the frog and the tortoise are able to contract ten days after excision; fragments of intestine have been kept alive a week; segments of arteries retain their contractility twenty days; and spontaneous movements of the eyes and face of a beheaded criminal have been observed ten minutes after decapitation. When we collate these facts, and make the very probable assumption that the survival of organs and tissues will be prolonged when we shall have learned more of the physical and chemical conditions

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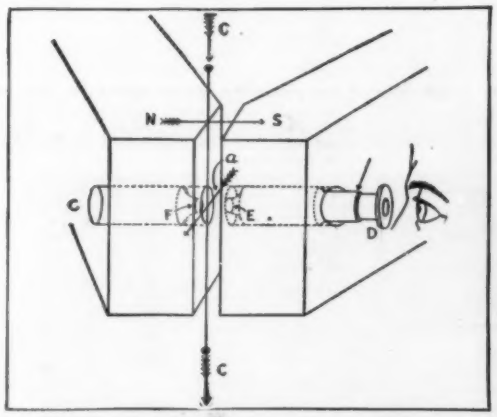
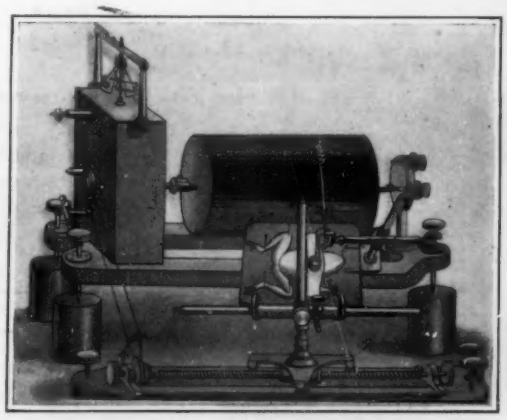
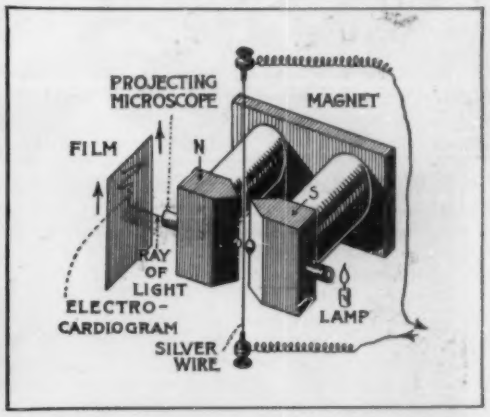


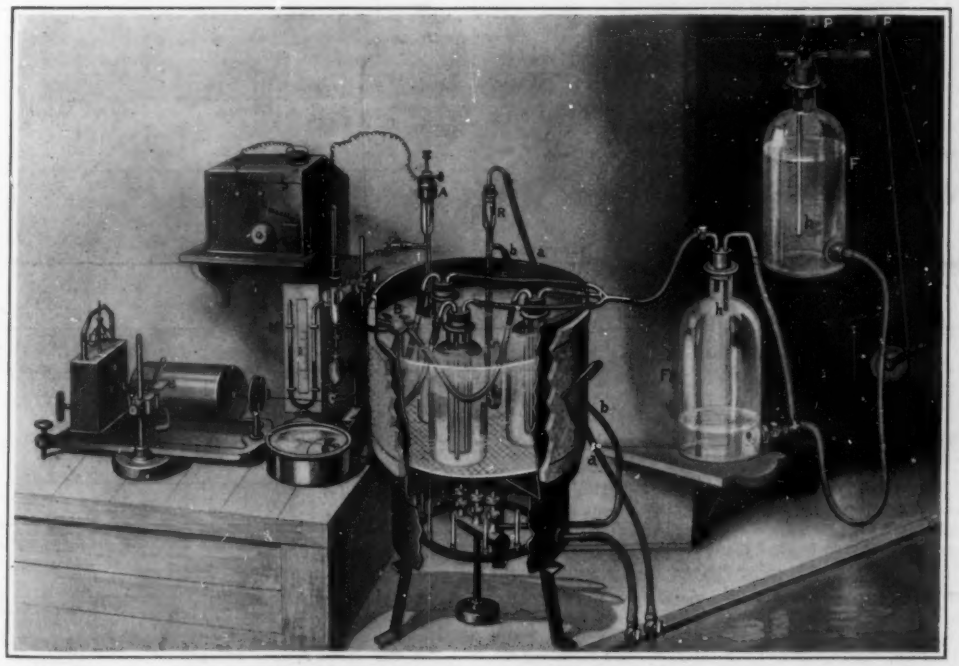

Diagram of the Einthoven string galvanometer.



Recording the contraction of a frog's heart.

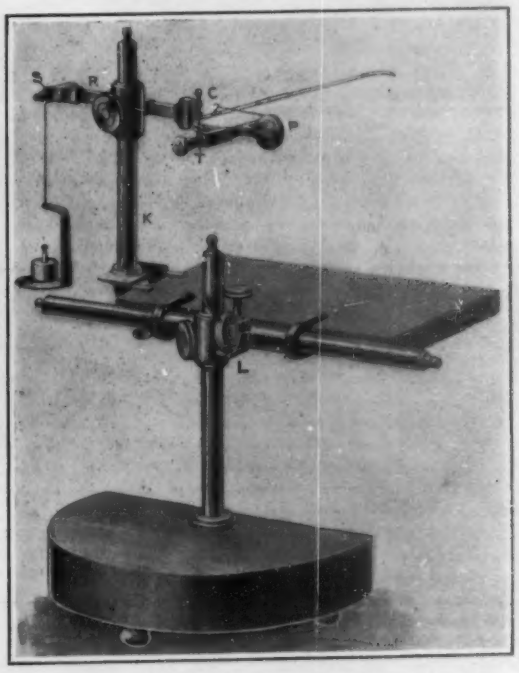



Einthoven galvanometer recording heart currents.



**B. Pachon's apparatus for irrigating the isolated heart with artificial serum.**

*A*, electric thermostat; *R*, gas thermostat; *B*, three-way connection; *C*, excised heart; *V*, bath to keep solutions at even temperature; *M*, manometer; *S*, battery, controlled by thermostat, rings bell on change of temperature; *F*, *F'*, pressure tanks; *e*, apparatus for recording heart action.



**The traction cardiograph.**

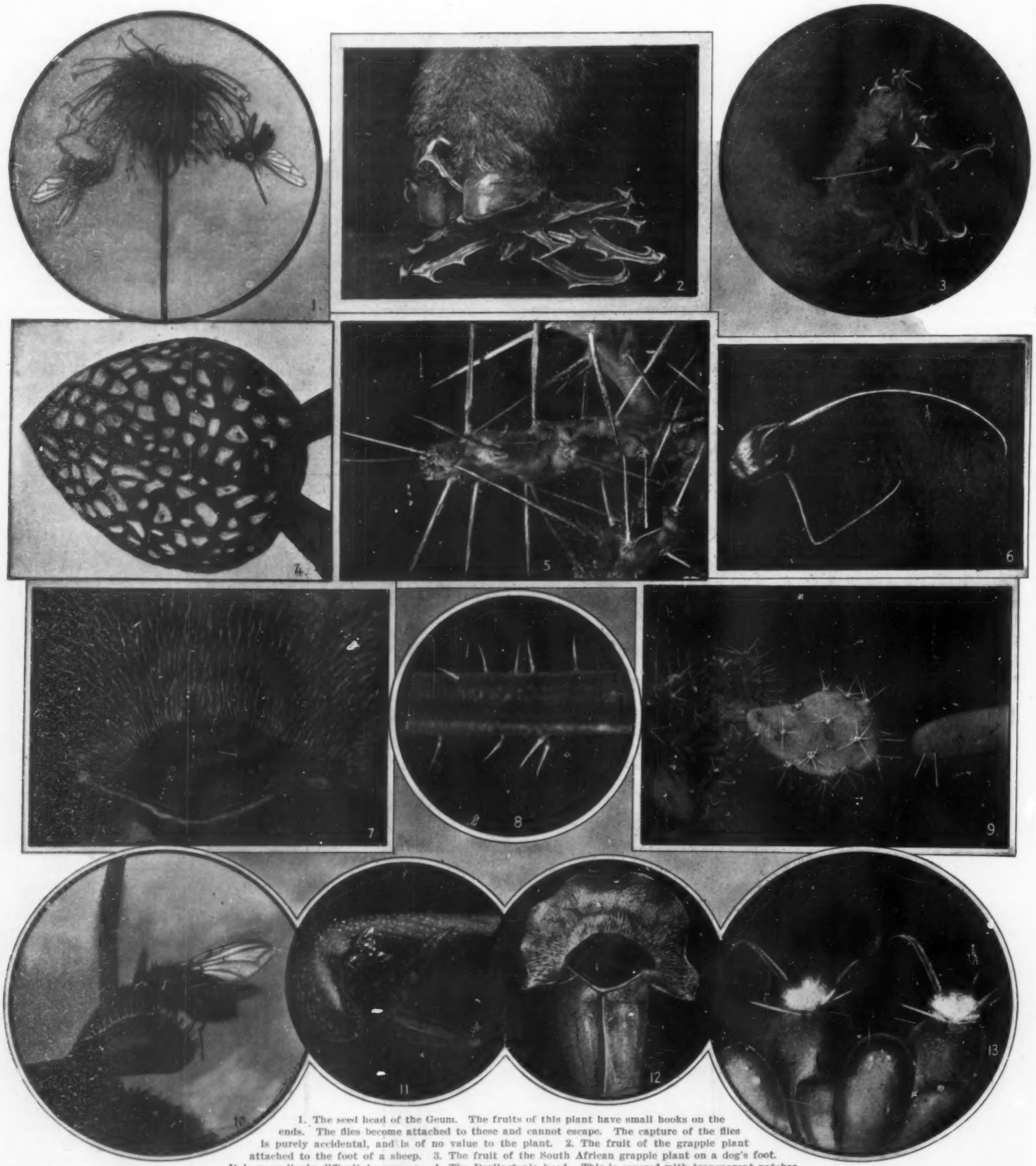
*L*, adjustable support for the operating table; *K*, support for recording devices. Connection with a frog's heart made by cord over the pulley *P* and attached at *C* to a siphon recorder.

# Are Plants Cruel?

## Brutal Injuries Inflicted on Insects and Animals

By S. Leonard Bastin

ONE cannot help thinking that many plants are unnecessarily brutal in some of the methods which have been adopted. It is, of course, well known that a certain number of species find it needful to capture insects in order that they may supplement their supply of nitrogenous food. In most of the schemes the unhappy victim is doomed to undergo the torture of a lingering death. Very rarely is the insect killed at once. First of all let us consider the case of the Darlingtonia, a plant which usually catches winged insects. The flies are lured by honey secretions to enter the hooded process at the top of the pitcher-like leaf. This




1. The seed head of the Geum. The fruits of this plant have small hooks on the ends. The flies become attached to these and cannot escape. The capture of the flies is purely accidental, and is of no value to the plant. 2. The fruit of the grapple plant attached to the foot of a sheep. 3. The fruit of the South African grapple plant on a dog's foot. It is exceedingly difficult to remove. 4. The Darlingtonia hood. This is covered with transparent patches which the captured flies mistake for openings. They beat themselves to death in vain endeavors to escape. 5. The terrible spines of a West Indian cactus. The smaller ones catch hold of the flesh and are very difficult to pull out. 6. The fruit of the South American Martynia has enormous hooks which are many inches in length. These plunge into the flesh of animals. 7. The bristles at the mouth of the pitcher of the side-saddle plant all point downward. Thus the unhappy insect, trying to escape from the pitcher, is thrust into the yawning pit below. 8. Why the nettle stings. The hairs (enlarged) show the little bulbs of poison at the base. The effect of some tropical nettle stings will last for days. 9. A cactus with minute barbs on its spines. The spines are loosely attached, and after penetrating the flesh, come away and are likely to cause blistering wounds. 10. The Venus fly-trap will not infrequently capture flies which are too large for its purpose. These wear themselves to death in vain endeavors to escape. 11. Darlingtonia Californica. This plant tempts flies to enter its curious hood. The insects cannot escape and are used by the plant as food. 12. The mouth of the pitcher of the Sarracenia is covered with hairs which makes escape impossible for the unfortunate insect. The hairs all point downward. 13. The "wait-a-bit" cactus. The hook catches hold of the tongue of the animal and inflicts terrible injuries.

**The cruelty of plants.**

they do by means of an opening on the underside. The whole of the upper portion of the hood is covered with transparent patches like so many windows. Now when the fly wishes to leave he naturally flies upward toward the light which streams down through these windows. The real opening is hidden in the shade of the under part, and passes unnoticed. Thus the flies simply beat themselves to death, in a vain endeavor to escape through the transparent places. This proceeding may extend over hours, but it always has one ending. The fly falls exhausted into the fluid at the bottom of the pitcher, and is drowned.

Very much the same thing happens in the case of the Side Saddle plant (*Sarracenia*). Here the insect is lured into the interior of the pitcher, but the exit at the mouth is barred by numerous sharp bristles which all point downward. It is almost impossible to crawl up against these processes and, after many futile attempts, the small beetle falls back into the horrible pit beneath.

Many flies meet with peculiarly brutal deaths in connection with the Venus fly trap. In an accompanying photograph is shown a capture by this plant. Here the victim was a large blue bottle fly, too big a specimen for the leaf to inclose. The insect was captured by its legs and held fast; meanwhile it beat its life away in vain endeavors to escape. An even more singular case was that to be observed in the fruiting head of the Geum. Here the fruits have small hooks, and the legs of flies are entangled in the processes. They cannot escape, and so must die miserably. The happening is, of course, a pure accident, and the flies are of no value to the plant.

The manner in which the dispersal of seeds is secured often involves happenings of a peculiarly brutal nature. In the first place let us take the case of the fruit of the Martynia, a South American plant. Here the capsule is armed with terrific hooks, sometimes as much as 5 or 6 inches in length. These are curved in such a way that they seize hold of passing animals, and plunge deeply into the flesh. It is said that bullocks are often driven half frantic with the pain produced by the cruel hooks. Frequently the most dreadful wounds are the outcome of the presence of the Martynia fruits, and the unhappy creature may not be able to get rid of its burden for several weeks. Of course the final result is that the seeds of the plant receive a very wide distribution, but a large amount of needless suffering seems to be involved.

Even more astonishing is the case of the Grapple fruit of South Africa (*Harpagophyton*). This species is of a low growing habit, and bears huge fruits, which are freely adorned with the most formidable barbed appendages. The fruit secures its dispersion in the following manner. In its position on the ground it is liable to be trodden on by sheep, deer, etc. At once, of course, the hooks catch hold and these penetrate into the tender places of the foot, between the horny portions. The unhappy animals limp about, and it may well be weeks before the dreadful burden can be thrown aside. During this time the most dreadful wounds are produced, and as well the creature is very likely to fall a victim to some beast of prey. In this connection a very singular happening sometimes occurs which is well authenticated. A lion captures an antelope with a grapple fruit on its foot. When making his meal, the lion gets the hooked capsule in his jaws, and the barbs speedily become entangled in the mouth parts. The more the lion fidgets, the less likely is he to get rid of the encumbrance, but owing to the pain and annoyance the beast cannot leave his mouth alone. So the miserable business goes forward. Days pass and the lion is quite unable to eat and as a consequence becomes weak and helpless. So the king of beasts dies, killed by the fruit of the Grapple plant.

It is of course recognized that plants must take certain means to protect themselves against the attacks of animals. Some of the measures which have been adopted are positively vindictive. Take the case of the common Stinging Nettle. Here the plant is covered with minute hairs which penetrate the skin, and at the same time inject an irritant poison, the effect of which lasts for hours. Some of the tropical nettles are much more terrible. The following is an account taken from the Himalayan Journals of Sir Joseph Hooker, in which an Indian nettle is described. "This plant, called 'mealum-ma,' attains fifteen feet in height; it has broad glossy leaves, and though apparently without stings, is held in so great dread that I had difficulty in getting men to help cut it down." No wonder the plant is avoided, for if a person is stung by the microscopic hairs the results are appalling. The pain is at first comparatively slight, but after a few hours the affected part feels as if it were being rubbed with a hot iron. Later the most distressing symptoms arise in other parts of the body, which not uncommonly involve the contraction of the muscles of the jaw, and other indications which are similar to those to be observed in a case of lockjaw. In one instance it was nine days before the unhappy individual was free from pain and discomfort. In such a case as this it would seem that a huge amount of unnecessary sufferings is involved. It is possible to protect a plant from attack, as can be seen in many cases, without adopting such brutal methods.

Self defense has been carried to a fine art among desert plants, especially in the case of the Cacti. A formidable array of sharp spines is of course an admirable means of preventing an attack from animals, but many species have carried the matter a good deal further than this. Here the idea seems to be not so much to repel the attack, as to do as much damage to the enemy as possible. In this way an enormous amount of suffering is caused. Some kinds of Prickly Pear (*Opuntia*) have minute barbs on their spines and, if any animal should attempt to attack the plant, or even brush up against it, the spines hold on firmly when driven into the flesh. They are very loosely attached to the plant, so that the unhappy creature takes away a large number of spines when he withdraws. These remain to produce festering wounds, and in this way bring about a large amount of pain. Another kind of Cactus has singular hooked spines as well as those of a more ordinary nature. On this account the species is called the "Wait-a-Bit" plant. Whether it should be the clothes of some passer-by or the tongue of an unfortunate animal the hook holds on, meanwhile the sharp straight spines do deadly work. The tearing away process, if the hook should be buried in flesh, is, as can be imagined, a most painful proceeding.

The instances given above are only a few out of a very large number, which might be brought forward to show that in many ways plants are guilty of great cruelty. One cannot get away from the idea that most of the suffering involved appears to be quite unnecessary, for there are plenty of instances to show that the same ends can be achieved in less painful ways.

## Electric Remote Gages for Shooting Ranges

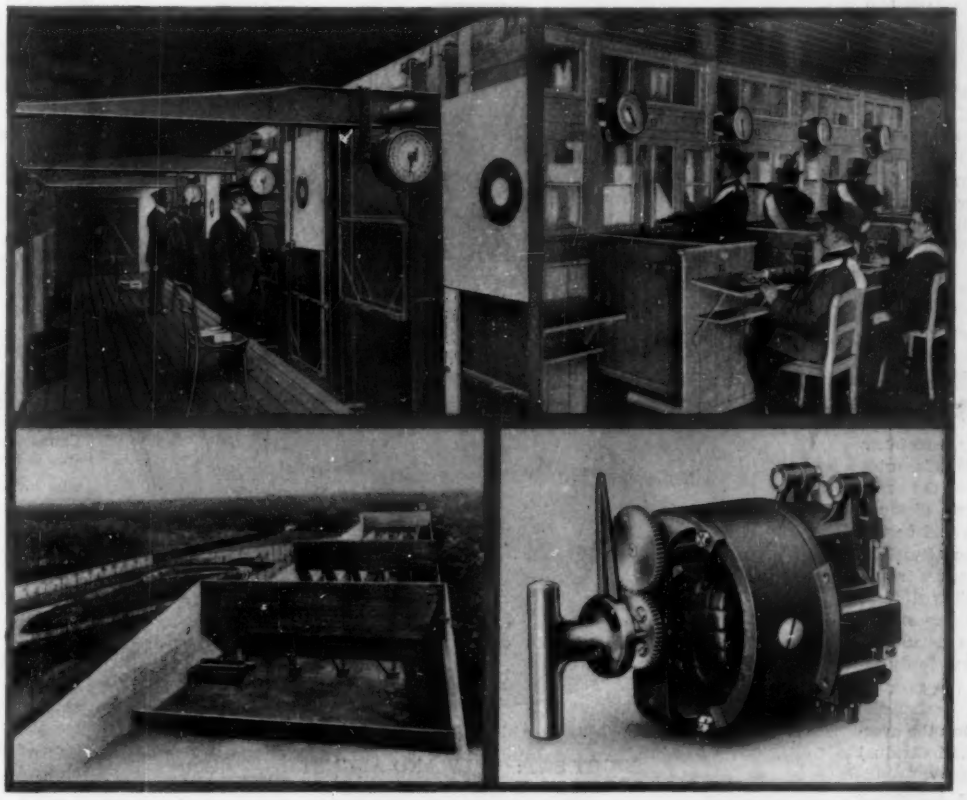
**By Our Berlin Correspondent**

ATTEMPTS have occasionally been made to employ electrical apparatus in shooting ranges for signaling the number of the ring hit at each shot, but the arrangements so far devised are of a rather rudimentary description, and could only be used in conjunction with the usual mechanical gages.

The Marksmen's Society at Spandau, near Berlin, has taken a decisive step in this direction, by having all its shooting ranges fitted with electric remote gages of a new system which offers a number of novel features.

The society owns extensive shooting grounds, comprising three 300-meter, twelve 175-meter, two 100-meter ranges, and one 35-meter range. Each range is fitted with a transmitter and receiver, serving to signal the number of the ring hit each time. Each of these apparatus, connected together by electric cables, comprises a scale, the twenty-three divisions of which bear the inscriptions 0, 1, 2, 3 . . . 20, "Telephone," and "Stop." The transmitter is installed to the left of the target, between the guide bars of two contiguous targets, there being no need for providing any special room for it, as in connection with previous installations. The receiver is arranged, in the shooting range, to the left of the marksman, and is readily read and checked by the latter, as well as by the secretary seated immediately behind him. Each transmitter and receiver comprises an index fitted with a handle, which is readily adjusted by hand, the index and handle of the transmitter being connected, in the interior of the casing, with an adjusting arrangement resembling a small electric motor, which insures perfect agreement in the readings of the two apparatus. The index of the receiver is shifted by a similar system, and being protected by a glass plate, cannot be interfered with by the marksman.

A set of transmitters in operation. Receivers installed beside the marksmen.



The shooting ranges at Spandau. The mechanism of the transmitter.

**Electric remote gages for shooting ranges.**

With each new reading, marksmen are advised by a short acoustic signal given by an electric buzzer, at the transmitter and receiver, which is readily distinguished from the bell signals employed for other uses. At the marksmen's post and on the desk of the secretary seated behind him, there are push buttons actuating simultaneously the buzzers of the transmitter and receiver, which are distinguished by their different timbre.

The installation further comprises a telephone plant. Watertight telephones, arranged in the passageway of each range, are connected up to an indicator switchboard installed in a special cabin, whence each telephone is readily called. In order to get a connection with his marksman, the man intrusted with the operation of the transmitter has only to adjust the index of the latter to the division "Telephone," thus causing the receiver index to take up immediately the same position and advising the marksman that he is wanted on the telephone. The telephone plant has been designed on the central battery system, the battery being installed so as to be sheltered from atmospheric influences; the telephone apparatus are joined together by means of armored cables.

The installation above described works as follows:

After taking up his post in the shooting range and firing his shot, the marksman presses down the push button on his left, thus actuating the buzzers of his receiver and transmitter and arousing the attention of the operator. The latter looks for the mark left on the target by the shot just fired, pointing out with a small rod, the section in which the mark is bound (top, bottom, right, or left). Having then taken down the target, he adjusts the transmitter index to the number of the rings hit by the marksman. While he is shifting this index, the electric buzzers of the transmitter and receiver are sounded simultaneously, and the receiver index takes up the same position as that of the transmitter. The operator finally pastes some paper on the

*(Concluded on page 639.)*

# The Heavens in July

## A Hundred and Twenty Thousand Years Hence the Tides Will Have Lengthened Our Day by One Second

By Henry Norris Russell, Ph.D.

IN last month's article we considered the singular "secular acceleration" of the moon's motion—that very slow, but steady, shortening of the month whose effects appear unmistakably upon comparison of the recorded observations of classical antiquity with the results of modern investigation. We may now spend a few moments in considering the causes of this phenomenon.

For more than a century after its discovery by Halley it remained entirely mysterious. The first light thrown upon it came from the keen mathematical insight of that great student of the celestial motions, Laplace.

Ever since Newton had discovered the law of gravitation, the difficult question of the manner in which the combined attraction of the Sun and Earth would cause the Moon to move had served to sharpen the wits of the keenest mathematicians. Newton himself had shown how the Sun, by attracting the Earth and Moon in different directions, and with different intensity (according to their varying distances and directions from him) sometimes produced a tendency for the two bodies to separate, and sometimes drew them together. These disturbing forces, though at most amounting to little more than one per cent of the Earth's attraction for the Moon, cause great changes in its orbit. A simple calculation shows that, though the Sun's influence often acts to reinforce the Earth's attraction on the Moon for three or four days at a time, it acts longer and more powerfully in the opposite direction, so that, on the average, through months and years the earth's attraction is diminished. The smaller this attraction, the longer will be the time which a satellite at a given distance will require to complete a revolution; so that the month is actually longer by some 53 minutes than would otherwise be the case.

Now the Sun's disturbing action upon the Moon depends on its average distance from the Earth. If the Earth's orbit around the Sun were always of the same size and shape, this average distance would be invariable, and so would be the length of the month. But the attraction of the planets causes slow changes in the Earth's orbit, and Laplace showed that, though these changes are at present of such a nature that the average distance of the Earth from the Sun is very slowly increasing—not the average of the greatest and least distances reached during the year (this remains constant) but the average of all the distances on the individual days of the year.

Hence the Sun's action in increasing the length of the month is slowly diminishing, and the month is getting a little shorter, century by century, so that the Moon slowly forges ahead of her position calculated without consideration of this fact.

The computation of the exact amount of this change is extremely intricate, but the results of Newcomb and Brown show conclusively that it would set the Moon ahead by 6.1 seconds of arc at the end of a century, or, in other words, would shorten the month by one second of time in 6,000 years.

It is worth remarking that this change will not go on forever. The decrease of the eccentricity of the Earth's orbit, in which it finds its origin, will come to an end about 25,000 years hence, and be followed by an increase, so that the month will shorten for these 25,000 years and then grow longer again.

But we are not yet at the bottom of the matter, for the observed rate of change in the month is one second in 3,400 years—about 70 per cent greater than that calculated above. There can be no doubt that the calculations and observations are both substantially correct, and it therefore appears that there must be at least two different causes simultaneously acting to account for the observed change.

Fortunately, another cause is known to exist, namely, the friction of the tides raised by the Moon in the oceans and even in the solid mass of the Earth. Anyone who has seen an old-fashioned tide mill has had visible evidence that the rise and fall of the tides *dissipates energy*—providing power which, if properly directed, can be used to perform useful work, but otherwise is "wasted" in stirring up and heating the tidal currents.

Now this energy must come from somewhere. It is easy to see that the only possible reservoir of energy which the tides can tap is that of the Earth's rotation; for if the Earth kept always the same face toward the Moon, and everything else in nature was the same as now, it would always be high tide (so far as the tides raised by the Moon were concerned) in the same place, there would be no rise and fall of the water on the coast, and no loss of energy by friction.

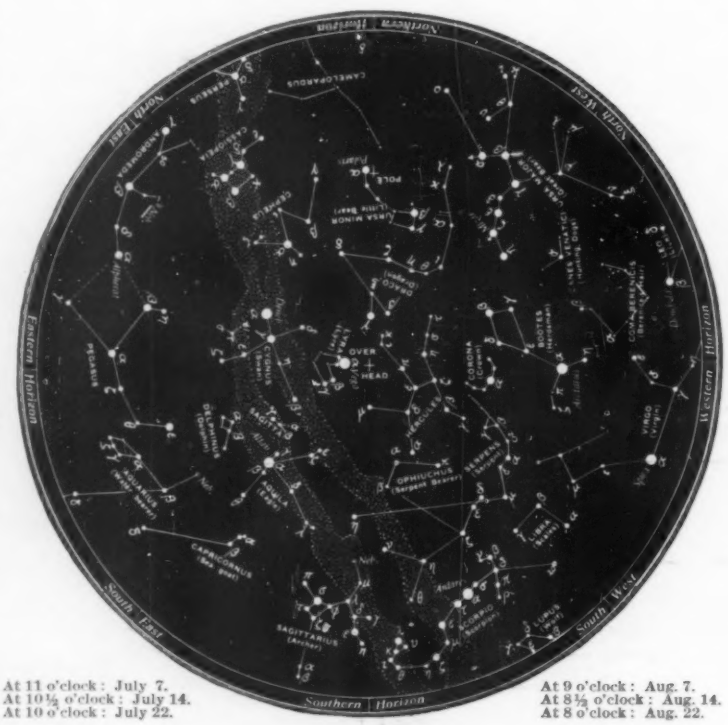
Hence we see that the tides must act on the rotating Earth very much as a brake acts on a rotating wheel, diminishing its rate of rotation very slowly to be sure, but steadily, and converting the energy of rotation into heat at the points where the brake is applied (i. e., in this case, where the tidal currents run).

In the course of ages, therefore, as the earth rotates more slowly, each day must get a little longer. If the Sun, Moon and planets keep on moving in reality at their original rates, they will go slightly farther in each of the new days than they would have done in the old ones, and so must gradually get ahead of our reckoning, because the Earth, whose rotation we use to set our clocks by, is itself like a clock which is gradually running slower and slower.

In the case of the Moon, the situation is somewhat complicated by the fact that (so to speak) she holds the other end of the brake—the connections being the invisible, but very real, bonds of mutual gravitation. Obviously, in the case of a flywheel, when the brake was clamped on its axle, it would be necessary to tie down the end of the brake lever to prevent its flying around with the axle and wheel. A corresponding force will act on the Moon, urging it forward in the direction of its motion. Calculation shows that the principal effect of this force will be to make the Moon's orbit grow larger, so that she will slowly recede from the Earth. In this larger orbit she will take longer to complete a revolution than in her original orbit, so that the tidal action tends in this way to increase the length of the month measured by a perfect timepiece. Computation shows that, under the existing conditions, this effect is more than compensated by the slowing of the Earth's rotation, so that, measured by our terrestrially adjusted clocks, the Moon will seem to run fast by almost the same amount by which she really goes slow.

To account for the outstanding secular acceleration of the Moon, remaining after allowance has been made for the gravitational action explained above, it is, therefore, only necessary to assume that tidal friction is slowing the Earth's rotation to such an extent that the day becomes one second longer at the end of some 120,000 years.

The similar secular acceleration of the Sun, recently discovered, indicates a more rapid change, amounting to a lengthening of the day by one second in about 25,000 years. The reconciliation of these two values remains as a problem for investigators of this difficult subject—some idea of whose complexity can perhaps be gained from the foregoing account, which deals with only its very simplest phases.




At 11 o'clock: July 7.
At 10½ o'clock: July 14.
At 10 o'clock: July 22.

At 9 o'clock: Aug. 7.
At 8½ o'clock: Aug. 14.
At 8 o'clock: Aug. 22.

At 9½ o'clock: July 30.

NIGHT SKY: JULY AND AUGUST

### The Heavens.

The brilliant region of Scorpio and Sagittarius is now full south, and visible at its best. Above this, on the right, is the extensive area of Ophiuchus and Serpens, to the left of which is Aquila. Below this again is Capricornus, with the pretty naked-eye pair which bears the Greek letter Alpha. Beta Capricorni, just below, is also double, having a companion visible in a field-glass.

The great square of Pegasus has just risen, and stands upon one corner in the east. Andromeda is also low, on the northeastern horizon. Cassiopeia and Cepheus are above her, and Cygnus and Lyra are high in the east—the latter almost overhead.

Draco and Ursa Minor are in the north, and Ursa Major in the northwest. The brightest star in the western sky is Arcturus. Spica is below him on the right, and Corona and Hercules are above, on the line toward Lyra.

### The Planets.

Mercury is a morning star this month, being at his greatest elongation on the 18th. At this time he rises about 3:30 A. M. and is easily visible before dawn. He is in the western part of Gemini, and Saturn is close by, the two planets being in conjunction and only 1 degree apart, on the 22nd.

Venus, too, is a morning star, about 5 degrees lower in the sky than the other two and rises about 20 minutes later. She is very much brighter than Mercury, which slightly exceeds Saturn in brilliancy.

Mars is a morning star, too, but is in Taurus, much farther west, and rises at about 1:30 A. M. in the middle of the month. Jupiter is in Pisces, close to the vernal equinox—the departure point from which celestial longitudes and right ascensions are measured—and rises at about 10:30 P. M. in the middle of the month. Saturn is a morning star, practically invisible in the early part of the month, but easily to be seen at its close.

Uranus is in Capricornus, about 2 degrees northeast of the fourth magnitude star Theta Capricorni, and comes to the meridian about 2:30 A. M. at the beginning of the month, and 12:30 A. M. at its close.

Neptune is in conjunction with the Sun on the 23rd, and is invisible this month.

The Moon is in her last quarter at 1 A. M. on the 4th, new at 5 A. M. on the 12th, in her first quarter at 4 P. M. on the 19th, and full at 7 A. M. on the 26th. She is nearest us on the 24th, and farthest away on the 8th. In her circuit of the heavens she comes into conjunction with Jupiter on the 3rd, Mars on the 8th, Venus and Mercury on the 10th, Saturn on the 11th, Neptune on the 13th, Uranus on the 27th, and Jupiter again on the 30th.

On July 5th the Earth reaches its greatest distance from the Sun, 94,400,000 miles; but, since the hemisphere on which we live is tipped toward the Sun, we get about the hottest days of the year.

The comet whose discovery by Delavan was announced last month, turns out to be a new return of Tempel's periodic comet, whose period is five years and two months. This comet, first discovered in 1873, has not been seen since 1904, as at its return in 1910 it was unfavorably placed. It will remain visible in the morning sky for some little time, but will decrease in brightness and soon become inconspicuous telescopically.

Princeton University Observatory.

**A Patent for Second Hand or Used Material in Tire.**—Orwin M. Thomas of Oakland, California, has secured patent No. 1,138,911 for a tire protector in which he provides between the outer casing of the tire and the inner tube a removably seated annular lining which he defines as "consisting of the continuous service-stretched fabric portion of a used outer casing" and described as free from stretching because of its previous use.

## RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

### Of Interest to Farmers.

EGG CARRIER.—M. BARROW, 119 Wooster St., New York, N. Y. The object of the present invention is the provision of a new and improved egg carrier arranged to permit the safe shipping of eggs by parcel post, express companies or other means of transportation. The egg carrier can be cheaply manufactured.

### Hardware and Tools.

SELF LOCKING HINGE.—C. DIENER, 1421 Myrtle Ave., Brooklyn, N. Y., N. Y. In this hinge spring means are provided to hold the leaves of the hinge in different relative positions immovable with respect to each other, the sleeves or knuckles of the hinge plates or leaves being designed to co-operate with each other or with spring-actuated means in order to hold the leaves of the hinge in certain relative angular positions or closed as desired.

SINGLE ACTING JAMB HINGE.—O. KATZENBERGER, 215 W. Huron St., Chicago, Ill. This invention relates to improvements in hinges and particularly to what are known as jamb hinges, and has for an object to provide a structure which may be adjusted so as to cause the door to swing shut or to cause the door to swing open.

### Heating and Lighting.

GAS BURNER AND AUTOMATIC CUT-OFF THEREFOR.—J. E. JARGSTORFF, 137 Henry St., Jamaica, L. I., New York, N. Y. This invention relates to an improved gas burner and automatic cut-off therefor designed to automatically cut off the flow of a gas whenever the flame from any cause becomes extinguished other than by means of the usual cut-off or gas cock controlling the supply to the burner.

GRATE BAR.—C. W. HOPES, Room 1204, 30 E. 42nd St., New York, N. Y. The main object here is to provide such bars which are designed for use in connection with rice, birdseye, or other fine anthracite or bituminous low-grade fuel, whereby said fuel is retained upon the grate and an even distribution of air supplied thereto in order to secure proper combustion, said air being diffused throughout all the fuel on the grate.

### Household Utilities.

MATTRESS.—NANNIE V. KNICKMEYER, Millville, Ga. One of the principal objects of the invention is to provide a mattress having means to facilitate the ready handling of the mattress during the process of shaking up and renovating the same, and in turning and handling the mattress, said means further serving to strengthen and maintain the mattress in shape.

CONVERTIBLE BED AND DIVAN OR SOFA.—J. LUPPINO, 445 55th St., Brooklyn, N. Y., N. Y. The improvement provides a convertible bed and divan or sofa, arranged to permit the user to swing the sections into extended position to form a double bed or into a folded position to provide a divan or sofa, the converting of the bed into a divan or sofa and vice versa requiring very little physical exertion.

BOTTLE AND JAR CLOSURE.—O. A. J. BECHER, Copiague, N. Y. This invention relates particularly to closures for bottles, jars and the like, and the object is to provide a structure which may be quickly applied and removed. It provides a cap or closure for a bottle or jar with a plurality of bent projections acting as threads for engaging and coacting with the threads on the bottle or jar.

CRULLER CUTTER.—A. VERSTRAETE, 40 North Ave., New Rochelle, N. Y. The improvement relates to hand-operated and directed bakers' implements, and its object is to provide a cruller cutter arranged to permit the baker to quickly and accurately cut a plurality of cruller blanks from a sheet of dough without incurring any waste of dough.

### Machines and Mechanical Devices.

UNIVERSAL STONE WORKING MACHINE.—O. BAUER, 35 Bay 32nd St., Brooklyn, N. Y., N. Y. The invention refers particularly to such machines as are employed in stone cutting or grinding. The invention provides an attachment for an ordinary stoneworking machine whereby the grinding wheel may be adjusted vertically simultaneously with the usual adjustments of the radius arms of the machine.

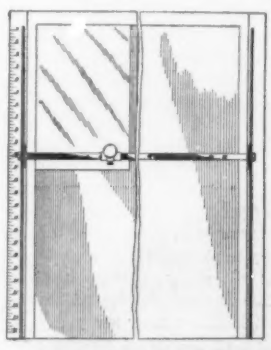
POWER ROCK DRILL.—F. P. PORTER, Kellogg, Idaho. This inventor provides a drill of the hammer type which is especially adapted for drilling holes in the sides of the roof of a mine, and which is arranged to reduce vibrations to minimum, thus allowing easy handling of the machine without undue fatigue on the part of the operator and to withstand hard usage.

RESILIENT TRANSMISSION GEARING.—A. F. DICKEY, Somerset, Pa. In this patent the invention has reference to transmission gearing and has particular reference to means for cushioning the driving action upon such gearing so as to relieve the mechanism from unnecessary shocks, jars or offensive clattering of the parts.

APPARATUS FOR REFINING PULP STUFF AND THE LIKE.—T. H. NASH. Address Day, Davies and Hunt, 321 High Holborn, Loudon, W.C., England. The invention provides a container for mixing the stuff which may be adapted to automatically eliminate or separate pieces of metal or other heavy objects in the stuff, a beating engine comprising one or more beater rolls, and arranged approximately on a level with the container so that the stuff gravitates through the beating engine, a regulable chute or gate connecting the beating engine with the container, and means for returning the stuff from the beating engine to the container.

PHOTOGRAPHIC ROLL HOLDER.—H. B. BARRIER, 2227 E. 3rd Ave., Spokane, Wash. An object here is to provide a device which may be attached to a camera box, and which is designed to hold films with means for pressing the films out flat when exposure is made and for releasing them and permitting their ready movement when shifting from one portion of the film to the other.

GLASS CUTTING MACHINE.—H. FALVEY, 4 Washington Ave., Parkville, Brooklyn, N. Y., N. Y. This invention relates to glass cutting devices, and particularly to a device for quickly cutting plate glass of any size, and provides an arrangement which will adapt itself to plate glass of different thicknesses, and also glass



GLASS CUTTING MACHINE.

which may not be perfectly flat. It provides a device with a supporting platform for plate glass, and means movable in two directions across the support so as to cut plate glass arranged thereon in two directions and thereby produce a perfectly square product.

ADVERTISING DEVICE.—J. B. FURBER, care of J. L. Hughes, 15 Clinton St., Newark, N. J. The invention involves the use of a manikin representing a half figure, with movable members, such as a leg and an arm, the manikin having concealed support and a mirror being so associated with the manikin that the latter and its reflection will present a com-

ADVERTISING DEVICE.

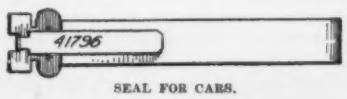
plete figure. Illusive effects are produced with respect to the apparently unsupported manikin and the movements imparted to the leg or arm thereof, the illusion being produced through the medium of the mirror and motor-driven actuating devices at the back of the mirror. The device is for display in a store window.

### Prime Movers and Their Accessories.

CARBURETER.—H. W. ALLEN, P. O. Box "R," Coalinga, Cal. This inventor provides a device wherein dampers are arranged between the inlet and the outlet of the carbureter for controlling the passage of the fuel and the air therethrough, and wherein a valve is provided for controlling the supply of fuel and wherein a controlling shaft is provided connected to the dampers and to the valve, for simultaneously operating both valve and damper.

### Railways and Their Accessories.

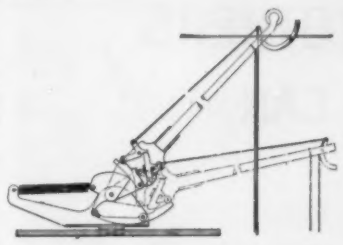
SEAL.—R. A. EDGAR. Address J. C. Hadley, 202 South Lincoln St., Chanute, Kan. The seal is for use in sealing cars and arranged to be used with the ordinary securing hasp and




SEAL FOR CARS.

staple and to be passed through the staple outside of the hasp, and then bent and folded upon itself in such manner that it cannot be detached without breaking the same, and thus indicating clearly to all concerned that it has been tampered with. The invention is an improvement on Mr. Edgar's prior Patent No. 933,700.

TROLLEY POLE.—J. DE ANGELIS, 40 W. 5th St., Mount Vernon, N. Y. This invention relates to trolley poles for electric railway cars or the like, and has particular reference to means for facilitating the engagement between

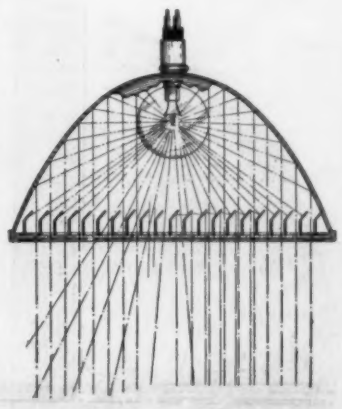


TROLLEY POLE.

the trolley and the overhead wire and also means of an improved nature to prevent damage to the pole or any other mechanism in the event of the trolley leaving the wire while in use.

### Pertaining to Vehicles.

NON-BLINDING DEVICE.—E. ADERENTE, 145 Sherman Ave., Jersey City, N. J. The device is adapted to be applied to high power headlights for automobiles and the like, the device being preferably, although not necessarily, in the nature of an attachment applied



NON-BLINDING DEVICE.

to the glass of the lamp for the purpose of so influencing the rays that they will practically all be directed on the road or street surface without producing any blinding effect upon pedestrians or occupants of other vehicles, since the rays of light are directed forwardly in a line below the ordinary level of sight.

OPERATING DEVICE FOR MOVABLE HEADLIGHTS.—M. GRIMORD. Address S. J. MCKINNON, 1114 Williard St., Ann Arbor, Mich. The invention provides a headlight control, including a connection between the reach rod and the lights, this connection being of such a flexible nature as to allow vertical movement of the rod relatively to the lights due to the movements of the vehicle in its road work, without resulting in any movement of the headlights, thus insuring a steady and unflickering light.

### Designs.

DESIGN FOR A DOLL.—T. H. HINDLE, JR., 2905 Avenue F, Brooklyn, N. Y., N. Y. This ornamental design represents an infant in standing posture, with arms extended and a startled expression of face.

DESIGN FOR FABRIC.—SOPHIE L. CROWNFIELD, care of E. F. Tirume & Son, 251 4th Ave., New York, N. Y. In this ornamental design for fabric, the attractive feature consists of an extremely original representation of patterns of irregular and sinuous form.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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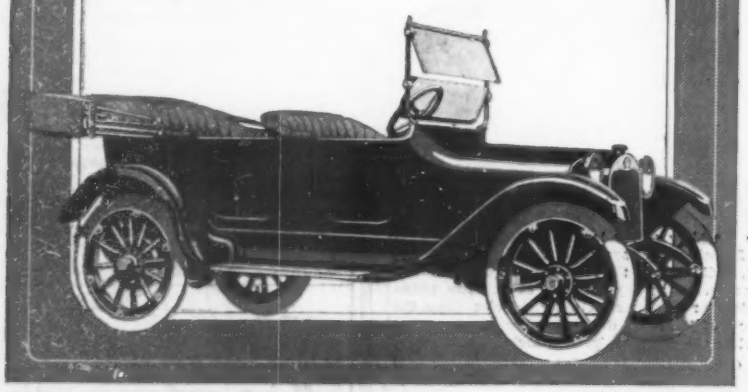


## Aeronautic Lessons of the European War

(Concluded from page 627.)

course of events has also shown that, after all, the "despised" German aeroplanes and dirigibles left little to be desired in this direction. It seems a foregone conclusion that the war will lead to a revision of notions about types of craft and of armament and to practising aerial attack and tactics in peace time as now destroyers fight sham battles. The Germans hardly ever dreamed of practising maneuvering for aerial combat before the war. Otherwise their types would be surely more versatile and the accounts of aeroplane duels would read differently. There is one peculiar, novel side to this air fighting. Never before in all warfare (barring "Leather-stocking Tales") has personal marksmanship evidently been at so high a premium. German writers have been complaining that it is the rarest chance if the same man shows the highest talent equally as a pilot and observer. Consequently, the Germans standardized the two-man machine. To be a virtuoso with a rifle is just as unique an accomplishment, to say the least. In future, lack of gifts for quick marksmanship will no doubt lead to the quitting of many an observer (just as it evidently accounts for the enigmatical turn of many encounters—English flyers are sportsmen). Those flyers who remain in the service (aeroplanes are costly implements), both pilots and observers, will enjoy ceaseless target practice. The natural development would be to ransack the whole army for perfect marksmen of minimum weight and ship three instead of two men, at least for short-range scouting, aboard the powerful Taubes and Albatross. Certainly the destruction of a Zeppelin will be followed by a revision of crews and shipping some crack shots on each. It seems strange that aboard the light, fast monoplanes shotguns are not also carried.

The "personal equation" in this experimental air-war shows also, especially in the handling of high-angle artillery, as some gun commanders on either side are given sobriquets and a wide berth by the flyers. An interesting detail is the fact that modern high-velocity bullets have ignited the gasoline in fuel tanks they perforated. Fibrous non-metallic tanks from which no sparks are struck may become a feature of future war machines. As Capt. Hacker (Count Zeppelin's aide) explained to the writer, the firing of the dirigible "Schwaben" by collision with the ground, from the fact that tearing steel wires let sparks fly, might shed some light on the Austrian report (contradicted by the Italian) that the dirigible "Citta de Ferrara" was ignited by a stream of aeroplane bullets. (This type has metal parts close to the gas bag.) Modern bullets are too tiny to be made incendiary shells. An inventor with such a purpose had recently to fall back on a discarded large caliber rifle. Such feats of dirigible destruction may be a matter of luck, just as the Zeppelin was hit only by the sixth bomb. Even this was the first performance of its kind. It seems that aviators have now learned the advisability of discharging all their bombs at once. The tiny steel bolts, occasionally dropped from aeroplanes, deserve hardly more than a passing mention. We may yet see a more businesslike brand, in larger quantities and slightly heavier, dumped from Zeppelins. Who could ever have foreseen that so bold a fancy as the proverbial "rain of pitchforks" might yet literally come true!

## The Instrumental Study of the Heart

(Concluded from page 631.)

of survival and the composition of artificial serums, we begin to appreciate the benefits that surgery has derived from laboratory experiments and the hopes raised by such bold attempts as those of Carrel and Tuffier.

These survivals and revivals of organs suggest the question: What is death and when does it occur? In point of fact, nothing is more certain than death, and nothing is more uncertain than the mo-

(Concluded on page 639.)


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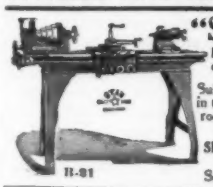


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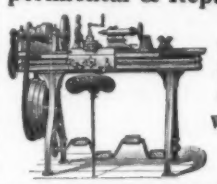

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leap after the removal of their heart and lungs. A tortoise moved its legs eleven days after decapitation; another lived six *months without a brain. Humboldt saw a* condor, which had been strangled and hung, walk as soon as it was released, and *stand erect after being shot four times* in the neck, breast and abdomen. A beetle half devoured by ants continued crawling normally and, according to Treviranus, a grasshopper moved its legs and antennae five months after it had been disemboweled and pinned to a board.

Susceptibility to death, therefore, appears to be associated with complexity and perfection of organic development.

### Electric Remote Shooting Gages

*(Concluded from page 633.)*

mark made by the bullet, after which the target is ready for another shot.

The first cost of this electrical outfit is, in most cases, more than made up by the saving in ground and accommodations. Operating expenses are exceedingly low. At Spandau, three-phase current at 220 volts, 50 cycles, is available for feeding the apparatus, thus allowing a very simple type of alternating current gage to be used. The 18 shooting ranges are arranged in six groups of three, and as each group has an armored underground cable of its own, any breakdown in operation will be limited to the three ranges of a given cable. Each group communicates with the electric mains through a transformer, stepping down the tension from 220 to 55 volts. The consumption of energy of each transmitter-receiver set is about 28 watts.

### Wire Rope

ALTHOUGH wire rope has been used as a mechanical appliance for almost 5,000 years, it is commonly regarded as a modern invention. During the many years which have elapsed since the first records of its use, wire rope has passed from a crude to a highly developed product, and the purposes for which it is employed have increased a thousandfold. In no other branch of the American steel industry is there so great a demand for material of proven integrity, for it might be safely suggested that wire rope is born to be abused. It is subjected to tremendous tensile strains; it must withstand constant bendings; abrasion, corrosion, and the peculiar internal stresses produced by vibration.

Wire rope, as it is made to-day, is the product of the metallurgist and the mechanic. Every process from the smelting of the ores, the cold drawing of the wires and the heat treatments they receive down to the stranding, or laying up, of the cable, is conducted with mathematical precision.

The chemist sees that only steel of the proper analysis is used; the electric pyrometer insures uniformity of heat treatment and various testing machines clearly develop the worth of the product before it is allowed to leave the mill. Wire rope is used in mine shafts more than a mile in depth, and may be found on aeroplanes which sail a mile or more above the ground.

A Boston firm has just been furnished with 3-inch diameter dredge-rope which has a strength of more than 645,000 pounds. The same mill that turned out this product makes the 1/16-inch cable which is embedded in automobile tires for re-enforcing purposes.

Wire rope is made for guying the poles of circus tents and then the tight-rope walkers and the ballet performers are provided with the means to display their arts in wire of the finest strand, but of surest strength.

Civilization is to a very great extent indebted to the wire-rope makers—for without them stores of minerals such as coal and copper would be virtually inaccessible; the construction of high buildings impossible, and the development of the country's every resource a hopelessly tedious task.

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### Not a New Type

The Cord Tire itself is not new. We have built Cord Tires since 1904. The English-French type, built abroad, is older still, but it never attained great vogue. Its virtues were dimmed by too many shortcomings, including high cost per mile. But, starting with that, we have for 11 years been building and bettering Cord Tires.

Cord Tires, *in cost per tire*, may exceed other types somewhat. The construction is rather expensive. Our aim has been to make extra mileage offset that higher cost. And the present popularity of Goodyear Cord Tires is due to our success.

### Multiplying Mileage

Goodyear Cord Tires, to this end, are built greatly oversize. That adds to tire life.

Then Goodyear Cord Tires have from 6 to 10 cord layers. Our 4-inch Cord Tire is an 8-ply tire. Our larger sizes are 10-ply. That means extreme reinforcement. Goodyear Cord Tires have our No-Rim-Cut feature, which combats a major waste.

These three great improvements—each exclusive to Goodyear—have multiplied Cord Tire mileage. Yet they sacrifice no iota of resiliency or comfort. And they add no extra price. Goodyear Cord Tires cost about the same as others of this type. Then, to make them utterly secure, we vulcanize 126 braided piano wires into each tire base. Goodyear Cord Tires need no hooks on the base—those hooks which "freeze" into the rim flange. For front wheels they come with a heavy grooved tread which aids steering. For rear wheels they come with our All-Weather tread, tough and double thick, with resistless sharp-edged grips. Those are some Goodyear supremacies.

### Cord Tire Virtues

Goodyear Cord Tires are tires of super-comfort. They are wondrous shock-absorbers. Never was a Cord Tire more resilient. Never was one better adapted to minimize trouble, give unusual mileage, increase speed and save power.

On electric cars, Cord Tires have long been the only advised pneumatics. Ease and comfort were most appealing there, and power-saving was of prime importance. Goodyear Cord Tires on electric cars add from 25 to 30 per cent to the mileage per charge. Now, with Goodyear improvements, many gasoline car owners are adopting these comfort tires.

When you come to Cord Tires insist on the Goodyear perfections. In them will lie this type's permanent popularity. Most electric car makers supply Goodyear Cord Tires on request. Most gasoline car makers who do not equip with them will supply them.

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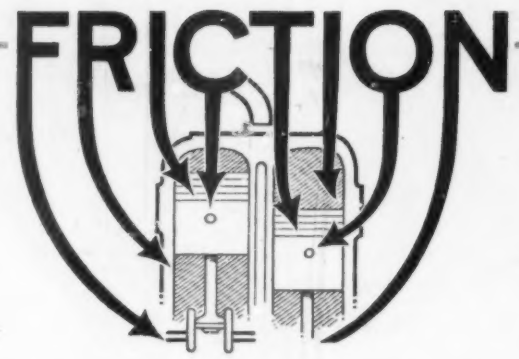
All-Weather Tread — Ribbed Tread

GOODYEAR AKRON, OHIO CORD TIRES

# FRICTION



## The Destroyer of Steel

Like the weight of an extra passenger, friction always rides with you.

It drags at your bearings. It robs you of power. It wears down metal. There are several thousand piston-strokes in a cylinder for each mile the car runs.

As friction can never be entirely overcome, it is imperative then that you use the best possible friction reducing oil for *your* motor.

Unless the *body* of your oil is adapted to *your* motor and feed system, it will not properly distribute between the moving parts.

And, unless its *quality* or lubricating efficiency is of the highest, it too quickly "wears out" under the constant rubbing between the moving metal surfaces.

At the right we print a scientific Chart of Automobile Recommendations. This Chart for a number of years has been the motorist's standard guide to correct lubrication.

The *body* of the oil specified for your car in this Chart enables it to feed in correct quantities to every friction point.

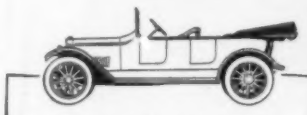
After it reaches these friction points, its *quality* assures a constant and proper oil cushion.

That oil cushion is your only insurance against premature motor wear.

It is your only safeguard against the noisy complaints of worn-down metal parts.

If you want to make certain of this protection, note down the grade of Gargoyle Mobiloils specified for your car. Then ask for that grade and see that you get it.

If your car is not listed in the partial chart at the right, send for the complete Chart which embraces 585 makes of car.



### Correct Lubrication

***Explanation:*** In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A". "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

| MODEL OF CARS | 1911 Summer | 1911 Winter | 1912 Summer | 1912 Winter | 1913 Summer | 1913 Winter | 1914 Summer | 1914 Winter | 1915 Summer | 1915 Winter |
|---|---|---|---|---|---|---|---|---|---|---|
| Abbott Detroit | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| " (8 cyl.) | | | | | | | | | A | A |
| Alco | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | | | | |
| American | A | Arc. | A | Arc. | A | Arc. | A | Arc. | | |
| Apperson | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Auburn (4 cyl.) | A | Arc. | A | A | A | A | A | A | Arc. | Arc. |
| " (6 cyl.) | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Autocar (2 cyl.) | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| " (4 cyl.) | A | Arc. | A | Arc. | | | | | | |
| Avery | A | E | A | A | A | A | A | A | A | A |
| " (Model C) 1 Ton | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Buick | A | Arc. | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. |
| Cadillac | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | | |
| " (8 cyl.) | | | | | | | | | Arc. | Arc. |
| Cartercar | A | E | A | E | A | E | Arc. | Arc. | Arc. | Arc. |
| " Com'l. | A | Arc. | A | Arc. | A | Arc. | | | | |
| Case | A | A | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Chalmers | A | Arc. | Arc. | Arc. | Arc. | Arc. | A | A | Arc. | Arc. |
| Chandler | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Chase (air) | B | B | B | B | B | B | B | B | B | B |
| " (water) | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Chenowth-Schofield | | | | | | | | | A | Arc. |
| Chevrolet | | | | | A | A | A | Arc. | Arc. | Arc. |
| Cole | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| " (6 cyl.) | | | | | | | | | A | A |
| Columbia | | | | | | | | | Arc. | Arc. |
| Commerce | | | | | | | | | A | A |
| Cunningham | A | A | A | A | A | A | Arc. | Arc. | Arc. | Arc. |
| Delaunay-Belleville | B | A | B | A | B | A | B | A | | |
| Detroiter | | | A | Arc. | A | Arc. | A | A | A | Arc. |
| " (6 cyl.) | | | | | | | | | Arc. | Arc. |
| Dodge | | | | | | | | | E | E |
| E. M. F. | Arc. | Arc. | Arc. | Arc. | | | | | | |
| Empire | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Fiat | B | A | A | A | B | A | B | A | B | A |
| Flanders | E | E | Arc. | Arc. | | | | | | |
| " (6 cyl.) | | | | | Arc. | Arc. | | | | |
| Ford | E | E | E | E | E | E | E | E | E | E |
| Franklin | A | Arc. | A | Arc. | A | Arc. | A | A | A | A |
| " Com'l. | B | A | A | Arc. | A | Arc. | | | | |
| Garford | A | E | Arc. | Arc. | Arc. | Arc. | | | | |
| " Com'l. | A | Arc. | Arc. | Arc. | Arc. | Arc. | A | A | | |
| Grant | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Hayes | A | Arc. | A | Arc. | A | Arc. | A | A | | |
| " (Model 6-66) | | | | | | | Arc. | Arc. | | |
| Haynes | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Hudson | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Hupmobile | | | | | A | Arc. | A | Arc. | A | Arc. |
| " (Model 20) | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | | | | |
| I. H. C. (air) | | | | | B | A | B | A | B | A |
| " (water) | | | | | A | A | A | A | A | A |
| International | B | B | B | A | | | | | | |
| Interstate | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Jackson | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Jeffery | | | | | | | A | A | A | Arc. |
| " Com'l. | | | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Kelly Springfield | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | A | A | A |
| King | A | E | A | E | A | E | A | A | Arc. | Arc. |
| " (6 cyl.) | | | | | | | | | Arc. | Arc. |
| " Com'l. | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Kissel Kar | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| " " Com'l. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | Arc. | A | Arc. |
| " " (Model 48) | | | | | | | A | A | A | A |
| Kline Kar | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | Arc. | A | Arc. |
| Knox | B | A | B | A | B | A | B | A | B | A |
| Krit | A | A | A | A | A | A | A | A | Arc. | Arc. |
| Leppard Stewart | | | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Locomobile | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | E | E | E | E |
| Lozier | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | Arc. | | |
| Lyons Knight | | | | | | | A | B | A | |
| Mack | A | E | E | E | E | E | A | E | A | E |
| " (Model B) | | | | | A | A | A | A | A | A |
| Marion | A | E | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Marmon | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Maxwell | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Mercer | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| " (22-70 Series) | | | | | | | | | Arc. | Arc. |
| Metz | B | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Mitchell | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Moline | A | Arc. | A | Arc. | A | Arc. | | | | |
| " Knight | | | | | | | A | A | A | A |
| Moon (4 cyl.) | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | Arc. | Arc. | Arc. |
| " (6 cyl.) | | | | | | | Arc. | Arc. | Arc. | Arc. |
| National | A | A | A | A | A | A | A | A | A | Arc. |
| Oakland | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Oldsmobile | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Overland | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Packard | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | Arc. | A | Arc. |
| Paige | A | Arc. | A | E | A | E | A | A | A | Arc. |
| (6 cyl.) | | | | | | | | | Arc. | Arc. |
| Pathfinder | | | | | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Peerless | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Pierce Arrow | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| " Com'l. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Pope Hartford | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | | |
| Premier | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Rambler | A | Arc. | Arc. | Arc. | Arc. | Arc. | | | | |
| Regal | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Rauch | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| Reo | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| S. G. V. | B | Arc. | B | Arc. | B | Arc. | A | Arc. | A | Arc. |
| Sauver | A | Arc. | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. |
| Saxon | | | | | | | E | E | E | E |
| Selden | A | E | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Simplex | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Stanchfield | A | Arc. | A | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Mead | | | | | A | Arc. | B | A | B | A |
| Stearns | A | Arc. | A | Arc. | | | | | | |
| " Knight | | | A | A | A | A | B | A | B | A |
| " (Light 4) | | | | | | | | | A | Arc. |
| Stevens Duryea | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Studebaker-Dayton | A | A | A | A | A | A | | | | |
| " Knight | | | A | A | A | A | | | | |
| Studebaker | A | Arc. | Arc. | Arc. | A | Arc. | A | Arc. | Arc. | Arc. |
| Stutz | | | Arc. | Arc. | Arc. | Arc. | A | A | A | A |
| Velie (4 cyl.) | A | Arc. | A | Arc. | A | Arc. | A | Arc. | A | Arc. |
| " (6 cyl.) | | | | | | | Arc. | Arc. | Arc. | Arc. |
| Walter | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | A | A |
| White | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |
| Willys Knight | | | | | | | A | A | B | A |
| " Utility | | | | | | | A | Arc. | Arc. | Arc. |
| Winton | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. | Arc. |

GARGOYLE

# Mobiloils

*A grade for each type of motor*

The four grades of Gargoyle Mobiloils, for gasoline motor lubrication, purified to remove free carbon, are:

**Gargoyle Mobiloil "A"**
**Gargoyle Mobiloil "B"**
**Gargoyle Mobiloil "E"**
**Gargoyle Mobiloil "Arctic"**

***For Electric Vehicles*** use Gargoyle Mobiloil "A" for motor and enclosed chains. For open chains and differential use Gargoyle Mobiloil "C."

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. For information, kindly address any inquiry to our nearest office.

**VACUUM OIL COMPANY, Rochester, N. Y., U. S. A.**

**Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.**

***DOMESTIC BRANCHES:*** Detroit, Boston, New York, Chicago, Philadelphia, Indianapolis, Minneapolis, Pittsburgh